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# Analyzing Food Security in Worcester

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# Analyzing Food Security in Worcester

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An Interdisciplinary Qualifying Project  
Submitted to the faculty of  
Worcester Polytechnic Institute  
In partial fulfillment of the requirements for the  
Degree of Bachelor of Science

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*May 15, 2012*

## Abstract

Our study, sponsored by the Worcester Food Policy and Active Living Council (WFPALC), assessed community food security in the City of Worcester. Quantitative data from the city's food retail outlets, including location, price, and food quality were examined against race, income, and ethnicity census data using a Geographic Information System (GIS). Qualitative data from interviews with local residents were synthesized to gain a nuanced perspective of how the city's low income residents negotiate the food system. This study demonstrated that food insecurity is more likely to affect ethnic minority and lower income residents.

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We would also like to thank Prof. Suzanne LePage for her considerable help and guidance in the use of the Geographic Information System.

Finally, we would like to thank all participants interviewed during the course of this project.

## Authorship

David Allen led the effort to collect quantitative data from stores around the City of Worcester. In addition to this he was responsible for researching data collection methods and adapting them to our project. He was the primary author of the abstract and introduction. He authored the background sections concerning the causes of food insecurity and its consequences as well as the methodology section establishing a means of measuring food availability, quality, and price.

James Filice assisted in representing collected data as maps using GIS. He authored the background section considering approaches to community food assessments taken in previous studies. He also conducted research on how to best estimate access to food retail outlets in addition to conducting GIS analyses. He was the primary author of the findings section for spatial analyses of food access, availability, quality, and price.

Neel Patel was in charge of all project GIS work. Neel gained proficiency with ArcMap 10 and used it to create maps and generated tables to represent collected data. He researched food security issues in Worcester, wrote analyzing spatial dimensions of food security in the Methodology, and formatted and edited the report. Neel also assisted in writing GIS findings and analyses.

Brandy Warner conducted resident interviews and authored the interview findings. She also researched methods for conducting interviews and wrote the corresponding methodology section.

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## 1. Introduction

Community food security has become a major concern on the national scale and can be defined as “the underlying social, economic, and institutional factors within a community that affect the quantity and quality of available food and its affordability or price...” (Cohen, Andrews & Kantor, 2002) Most people would assume that the U.S.A. has very food secure communities, however “11.1 percent of United States households and 12.2 percent of all individuals, representing more than 36.2 million people, were food insecure at one or more times in 2007” (Nord, Andrews & Carlson, 2008p.16). Community food insecurity does affect certain groups more than others. In fact of African American and Hispanic households, 22.2 percent and 20.1 percent, respectively, were considered food insecurity at some time of the year and 37.7 percent of households with incomes below the Federal Poverty Level (FPL) were food insecure. (Nord, Andrews & Carlson, 2008, p.18) While community food security is a multifaceted issue, it is most notably “correlated with the state of the economy. When the economy is expanding and unemployment is low, the amount of food insecurity declines; when the economy is contracting and unemployment is rising, food insecurity increases.” (Cook, 2002, p.12) As expected, food insecurity can have devastating and wide spread consequences. These consequences can range from increased thoughts of suicide or depression (Alaimo, Olson & Frongillo, 2002), risk of obesity (C. M. Olson, 1999), malnutrition, and even tendency to act violently and commit crimes (Kleinman et al., 1998).

Ideally community food security could be improved and sustained through a wide range of policies and programs designed to address food inequalities of the community. In the United States Department of Agriculture (USDA) Community Food Assessment Toolkit it states that the USDA has implemented food stamp outreach programs, farmers’ markets, community gardens, food-buying cooperatives, community supported agriculture, farm to school initiatives, and community kitchens in order to combat food insecurity. While these programs have improved the security of many communities, many of them are not properly funded, staffed or maintained leading to only a relatively small success from the potential they possess. The small success of these programs may have reduced overall food inequalities in the U.S but poor neighborhoods (neighborhoods defined as below the poverty line) still grapple with food inequality daily. In a study of four communities it

was found that “persons living in lower-income neighborhoods consumed less fruits, vegetables, and fish but more meat than those living in higher-income neighborhoods.” (Diez Roux et al., 1999) Another similar study found that there was “over 3 times as many supermarkets in wealthier neighborhoods compared to the lowest wealth areas.” (Morland, Wing, Diez Roux & Poole, 2002). This dietary inequality combined with the availability of less food in poor neighborhoods illustrates the limits of USDA’s policies and programs to meet the community’s needs.

Food insecurity is a problem for many residents of Worcester. 1. According to a recent study by the Worcester Food and Active Living Policy Council (WFALPC), out of the 14 low-income neighborhoods in Worcester, one child in three lives in a family that cannot meet its basic nutritional requirements. Between 2001 and 2005 there was a 40% increase the in number of people served by various soup kitchens and food panties associated with Worcester County Food Bank (Hunger in America 2006) and that number has grown since the economic crisis of 2008. The link between food security and health are highlighted in a 2006 study which showed that “Among adults reporting health problems, 65 percent were food insecure” (Nord, Andrews & Carlson, 2005) and over 24% of Worcester residents are obese (WFALPC, 2006). Clearly food security has become a pressing issue in Worcester.

This project’s sponsor the WFALPC has initiated programs to help reduce food insecurity among Worcester residents, particularly children, and low income and minority residents. From 2006 to the present they have overhauled the public school meal system, signed up 344 people for Supplemental Nutrition Assistance Program (SNAP), worked to increase state wide SNAP participation, established two farmers’ markets in USDA classified food deserts, created an educational garden at a local school, developed a program to teach healthy cooking skills and has advocated for several policy changes on the local and federal level. In the next phase of its work, the WFALPC wants to gain a better understanding in broad terms of the workings of the local food system—where food is produced in the city and in the region, the distribution of food outlets across the city, how ethnicity and income affect access and availability of healthy food, and how local residents address barriers to food access and define their local food environment.

Our project intended to aid the Worcester Food and Active Living Policy Council better understand food access availability among low-income residents in specific neighborhoods of Worcester. The project provides food policy-makers with resources such as maps and spatial

analyses of Worcester's food system, analysis of residents' perceptions of the local food system, and a set of recommendations for addressing food.

## 2. Background

### 2.1 *Towards a Definition of Community Food Security*

There is no one simple definition of community food security. In a well know article, Hamm and Bellows (2003, p.37) define it as “...a condition in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self reliance, social justice, and democratic decision-making.”

This definition of community food security is built on the notion of closer regional connections between growers, distributors, wholesalers, retail outlets and consumers. In this way it poses a challenge to the more established systems by which food flows through communities: market based corporate food production; food relief (food pantries, etc.) and the federal nutrition safety net. Despite this challenge a community food system guided by the framework of community food security and supported by community food assessments (CFAs) has many benefits. Pothukuchi (2004) states that some of these benefits that affect the whole community include greater participation in local food planning, greater connection between food security and community goals and reduced costs to some segments of society. Even at the household and individual level benefits can be seen such as greater knowledge of the local food system, increase in job opportunities, greater say in the planning of the local food system and greater possibility for social accountability (Pothukuchi, 2004). Aside from those specifically stated a food system guided by the framework of community food security and supported by CFAs would be able to identify problems earlier, use knowledge gained from previous CFAs to address the root causes of problems quickly and provide recommendations based on unique qualities of the community.

### 2.2 *Causes of Food Insecurity*

The primary causes of food insecurity are numerous and as complex as the issue of food security itself. Nord, Andrews and Carlson (2003) state the causes of food insecurity to be “...low and unstable income, unemployment and unstable employment, disability, family disruption, and lack of community and extended family support.” Cook states that food insecurity, like poverty, is directly connected to the state of the economy and notes that “...when the economy is expanding

and unemployment is low, the amount of food insecurity declines; when the economy is contracting and unemployment is rising, food insecurity increases” (Cook, 2002, p. 153). The common theme is that income or financial stability is directly related to access to healthy food. Generally, as income increases, the barriers to accessing healthy food such as transportation or pricing tend to diminish in size. Nord, Andrew and Carlson (2003, pp.2-19) support this by showing that in 1995 the “U.S. Government set a goal for the Nation—expressed in the Department of Health and Human Services' Healthy People 2010 objectives—of reducing the prevalence of food insecurity from 12 percent (as measured in 1995) to 6 percent or less by 2010” (Nord et al, 2003, pp.2-19). Initially “...food insecurity declined by 1.7 percentage points and the prevalence of hunger fell 1.2 percentage points...” (Nord et al., 2003, pp.2-19) however, as the economy entered the recession in 2001 food security and hunger increased, reversing the progress made by the Healthy People 2010 Program.

### ***2.3 Consequences of Food Insecurity***

The evidence or effects of food insecurity are prevalent in many aspects of society. A study by the United States Department of Agriculture (USDA) showed that 11.1 percent of United States households and 12.2 percent of all individuals, representing more than 36.2 million people, were food insecure at one or more times in 2007 (Nord, Andrews & Carlson, 2008, p.4). This meant that there were “...a total of 691,000 children living in ‘very low food security’ households in 2007...” (Nord et al., 2008, p.14). This shows that not only is food insecurity affecting a significant portion of the U.S but that it has been increasing in magnitude since 1998 when it was estimated that only about 2.75% of the U.S. population had inadequate caloric intake (Kramer-LeBlanc & Carol, 1998, pp.49-78). In 14 years the percentage of people in the U.S that are food insecure has quadrupled. The prevalence of nutrition related diseases has also skyrocketed; obesity, diabetes and heart disease are among the most serious.

Obesity, a rising national concern, is defined as maintaining a Body Mass Index (BMI) higher than 30 kg/m<sup>3</sup>. In 1994, sixteen states had an obesity rate of between 15-19%, yet in 2009 those same sixteen states had obesity rates ranging from 25-32% (CDC, 2009). Currently the Center for Disease Control and Prevention (CDC) estimates that over one-third of U.S. adults (35.7%) are obese and approximately 17% (or 12.5 million) of children and adolescents aged 2-19 years are

obese. Below is a map provided by the CDC, that shows the prevalence of obesity in the U.S by county for 2009. When examining the root causes of obesity we found that weight gain can only take place “...when a person consumes more calories than they burn. For many people this boils down to eating too much and exercising too little” (Nazario, 2011). Proper diet coupled with an active lifestyle can greatly reduce the chances of becoming obese. Therefore, if a community had a high level of food security, residents would be at reduced risk for becoming obese because of availability and access of healthy foods.

When examining Figure 1 below, a couple trends are easily identifiable. A majority of the map is represented by the two darkest colors, indicating high levels of obesity. It is also clear that the state with the least obesity is Colorado and the state with the most obesity is Mississippi. The South, especially the area surrounding Mississippi, contains a very high percentage of the total dark red area, which denotes over a 30.8% obesity rate by county population

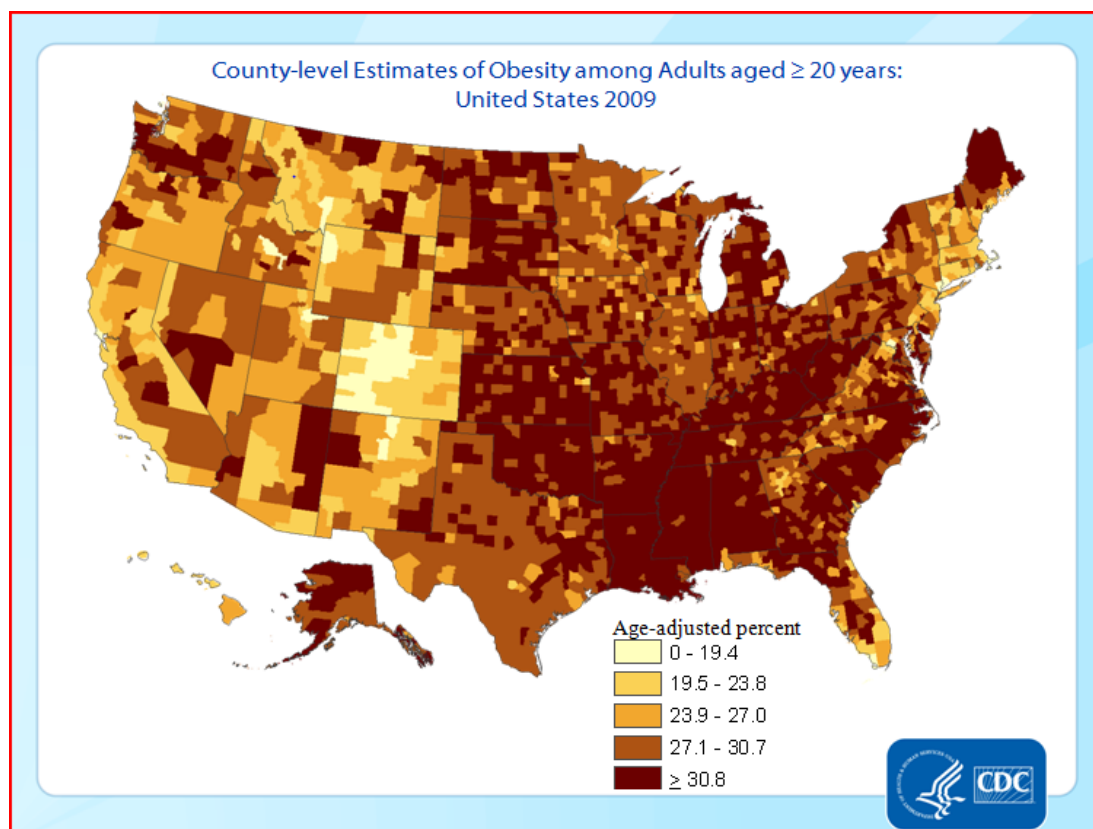


Figure 1: Prevalence of Obesity in the United States

Diabetes has also grown common in the U.S. Today over an estimated 25.8 million children and adults, or 8.3% of the total population have diabetes (Diabetes Basics, 2011). In 2010 alone 1.9 million cases of diabetes in people 20 years or older were diagnosed (Diabetes Basics, 2011) and it is extrapolated that by 2030 this number will continue to rise past 30.3 million Americans (Wild, Roglic, Green, Sicree & King, 2010). In fact, the most shocking statistic regarding diabetes in the United States is that a whopping 79 million people are estimated to have pre-diabetes, a condition where some but not all criteria for diagnosing diabetes is met ("Diabetes Basics," 2011). Common risk factors for diabetes include high-fat diet, obesity, high blood pressure, and a sedentary lifestyle (Ferry, 2012). It is clear that diabetes like obesity is largely controlled by diet. If a person maintained a USDA “food plate” diet they would lower the risk of developing diabetes. In that respect, a secure community food system would be able to significantly influence the population’s risk of developing diabetes by providing healthy food choices equally to all people.

Figure 2 represents the spatial distribution of prevalence of diabetes by county. Figure 2’s layout closely resembles Figure 1, which is reasonable because as obesity greatly increases a person’s chance of developing diabetes. Therefore, the same trends from Figure 1 are present in Figure 2, but to a lesser extent. While a majority of Figure 1 displayed the two darkest colors, Figure 2 is more balanced with a relatively equal match between the two darkest and the two lightest colors. This indicates that obesity affects more people than diabetes.

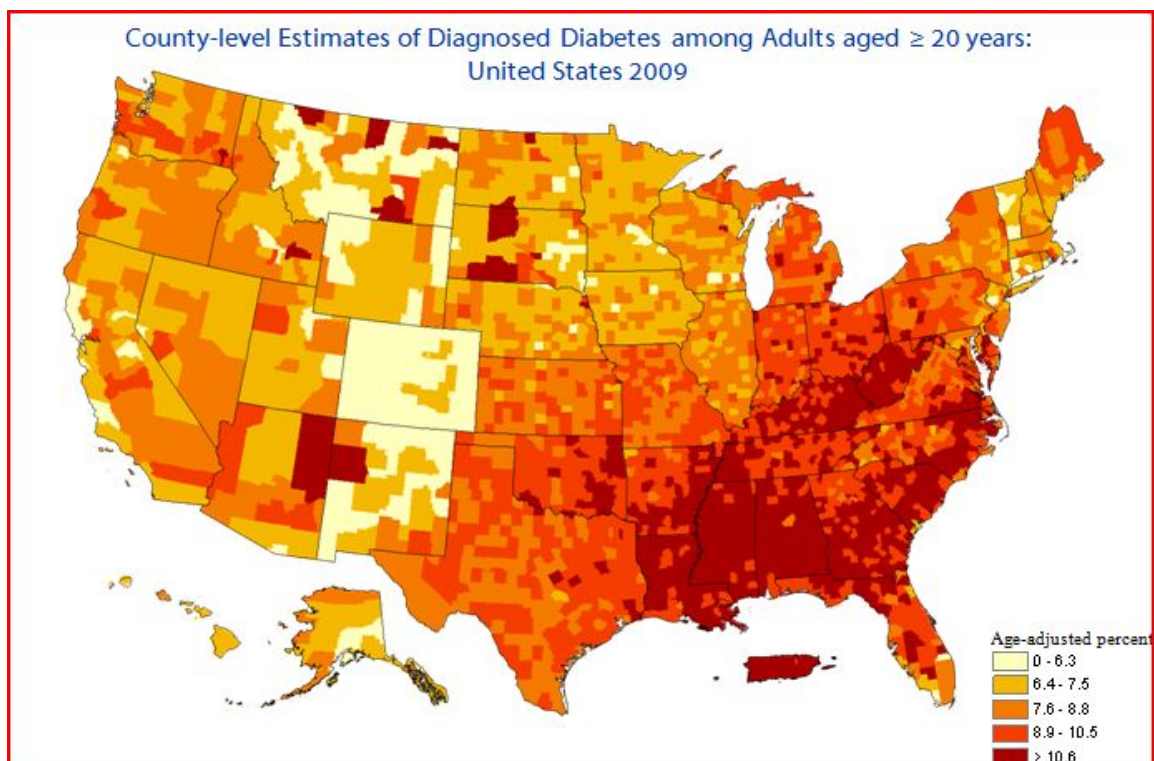
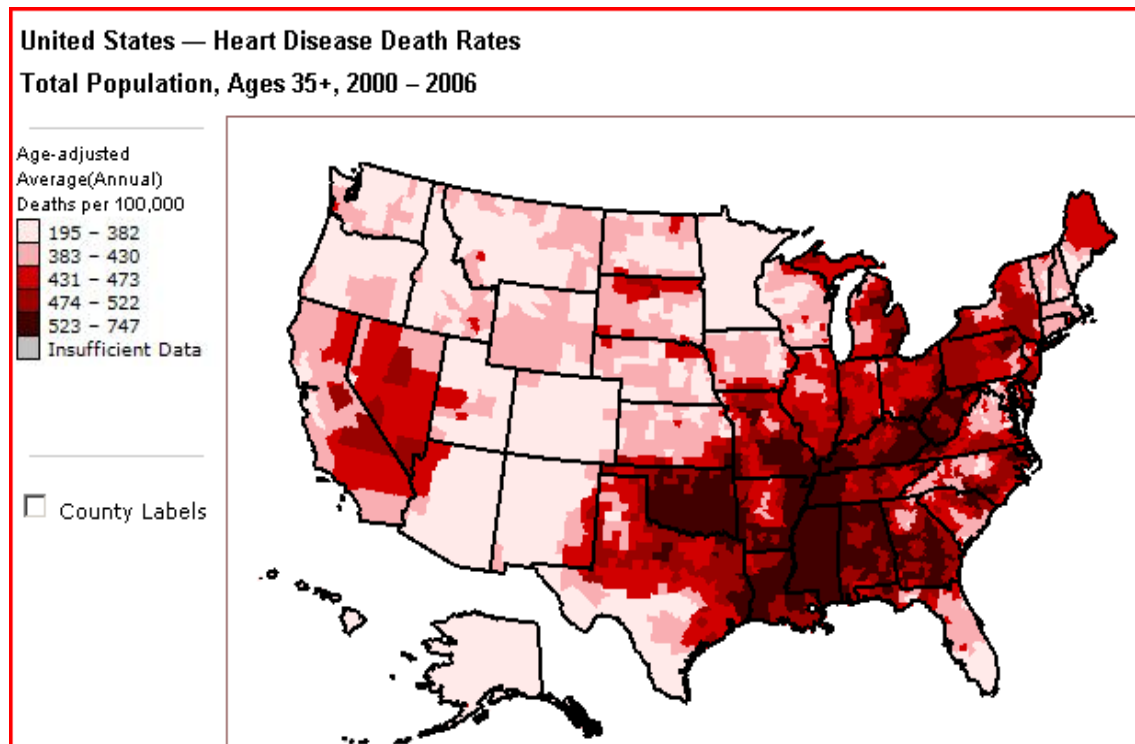


Figure 2: Prevalence of Diabetes in the United States



Heart disease is a severe problem in the United States. It is estimated that over 27.1 million adults or 11.8% of the population is diagnosed with some form of heart disease (CDC, 2009). Heart disease is also the leading cause of death in the U.S. The CDC found that "...in 2008, over 616,000 people died of heart disease..." which consisted of almost 25% of the total national deaths. Heart disease has many similar risk factors as diabetes which includes high cholesterol, high blood pressure, obesity, diabetes, lack of exercise and a high-fat diet (Singh, Forker, Talavera & Zevitz, 2012). Therefore it is already established that nutrition and diet can impact heart disease if it already directly controls diabetes and obesity which are heart diseases largest risk factors. It also must follow that if a community's food environment could provide adequate amounts of healthy food to the entire population through socially acceptable means then that community would be at significantly small risk for heart disease.

Figure 3 compares spatial location and rate of heart disease mortality. In areas with the highest mortality rate (747 out of 100,000), there is 1 death per 134 people from heart disease annually. Figures 3 as well as Figure 2 correlate heavily to the distribution displayed by Figure 1. This denotes that obesity, diabetes and heart disease must have commonalities, one of which is diet or nutrition. The same trends can be seen from Figure 3 as well as Figure 1 however they are to a much lesser extent. Figure 3, however, displays the majority of the map as the lightest two colors indicating less severity. This map also represents deaths from heart disease and not reported cases like obesity and diabetes. Lastly it is notable that for all three maps that Mississippi maintains the highest level of obesity, diabetes, and deaths from heart disease, which is most likely due to food insecurity.



**Figure 3: Heart Disease Mortality Rate in the United States**

There is a clear connection between food security and the health of a population. A person consuming an appropriate amount of food relative to their caloric output using the USDA’s “food plate” as a guide is proportionality at a substantial lower risk for developing any nutrition related disease such as obesity, diabetes or heart disease. Acknowledging that a community’s food environment directly impacts the food choices of anyone living within leads to the understanding that a secure community food system not only positively impacts the way people eat, but save lives. In order to understand all the mechanisms of a specific food environment and of a secure food system, a community food assessment must be conducted.

## **2.4 Approaches to Community Food Assessments (CFAs)**

Communities wishing to evaluate weaknesses in their food systems are tasked with gathering information and analyzing it with the goal of improving residents’ access to nutritious food. This is the purpose of a community food assessment. In essence, the methods employed for conducting a

CFA can be classified as one of two broad categories: qualitative or quantitative. Both approaches are necessary to reach well-informed conclusions about the food environment in a target area. Quantitative data include things such as Census demographic data and food pricing data. Qualitative data include interview and survey responses meant to gauge resident attitudes towards food.

A common shortcoming of CFAs is a deficiency of resident interviews for the purpose of gaining a more nuanced perspective on a community's food security. Descriptive statistics are used in most every study with Franco et al. (2008) taking a more rigorous statistical approach. Statistics, however, provide an incomplete picture of the community food environment. Interviews with residents are recommended by Cohen (2002) to fill in these gaps in knowledge for the purpose of conducting a successful CFA.

The goal of a successful CFA is to equip policy makers with the information they need to enact laws and take actions that will aid in making a community's food supply healthier and more accessible while reducing the degree of food injustice experienced by minority and low-income residents. Each CFA has a unique approach to this problem, but there are elements that are common across many of them. Porthukuchi (2004) provides a synopsis of several seminal community food assessments. Table 1 offers an overview of the commonalities between these studies.

	Goals	Methodology	Distribution	Outcomes
Los Angeles, CA	Assess food access in inner city Adequacy of Federal Food programs Propose framework for community food security planning	Censuses Demographic land use Telephone and in person Surveys Price Comparisons Local policy analysis Case studies	Report Press Releases Community Presentations Professional Journals	Formation of LA Community food security network Growth of Community gardens Food Assessments in other Counties Catalyst for community food security in the US
Berkeley, CA	Enhance Community knowledge and awareness of local food systems Study feasibility of new ways to link farmers' markets and communities	Local Organizational and agency data Surveys of business owners, school children, and non- profits	Report Press Releases	Formalized collaboration between Berkeley Food Policy Council and area producers, retailers and community based non-profits. Created new study materials
Somerville, MA	Strengthen planning and policy for community-based food and nutrition resources for low-income families	Census of population and Institutional data  Key informant, stakeholder interviews	Report Media contacts Community Presentations	Publications of an extensive community food and nutrition guide Cooking classes for low income residents Implementation of community Kitchen Task force Formation of Public Health Nutrition Task Force

**Table 1: Commonalities Between Los Angeles, Berkeley, and Somerville CFAs (Synthesized from Porthukuchi (2004)**

Table 1 shows that while the LA, Berkeley, and Somerville share similarities in their results and in establishing community outreach programs, they achieve these means in different way. The LA and Somerville studies make extensive use of Census data for the purpose of assessing community food security levels. This is a theme that is also common to several more recent CFAs as well.

More recent studies such as Lopex-Class and Hosler (2010), Haering and Franco (2010), and Franco et al. (2008) chose to represent socio-economic variables from the U.S. Census spatially in the form of maps generated in a geographic information system (GIS). Representing information visually makes it more intuitive. Haering and Franco (2010) use this method in mapping the locations of different store types in the city of Baltimore. In addition to simply acting as a visual aid, GIS acts as a powerful tool for examining socio-economic variables with respect to location. Furthermore, GIS can be used to perform spatial-statistical analyses ranging from simple percentage calculations using U.S. Census demographic data to more complicated statistical tests. Using these analytical methods, previous reports were able to establish clear trends and relationships between race/ethnicity, income, and food insecurity.

Unequal food retail outlet distribution and social inequalities in the food systems were the two clearest patterns we found in reviews of the seminal literature. Haering and Franco (2010) in their CFA of Baltimore looked at resident race and its relationship to neighborhood food availability and access. In the same study, Haering and Franco (2010) classified the U.S. Census 2000 tracts comprising the city of Baltimore as predominantly white ( $\geq 60\%$  of tract population reported as white), predominantly black ( $\geq 60\%$  reported as black), or racially mixed (block groups which did not fit into the previous two categories). This focus on racial characteristics of the city arose out of “...racial health disparities typical of many modern US cities” (Haering and Franco, 2010, p. 4).

In a study of Latino neighborhoods in upstate New York, Lopez-Class and Hosler (2010) strongly emphasized the importance of the rapidly growing Latino demographic. According to Lopez-Class and Hosler (2010, p. 1), “Many low-income Latino communities experience significant food insecurity...” This is significant to our study because the United States Census Bureau reported that 20.9% of Worcester residents claimed Hispanic or Latino origin in the 2010 Census—a significant portion of the overall population.

In addition to ethnicity and race, another factor which significantly affects community food security is poverty. In an earlier CFA of Baltimore, Franco et al. (2008) took into consideration the racial characteristics of neighborhoods within the city as well as the income of those neighborhoods. According to Franco et al. (2008, p. 561), “Prior research has documented the associations of neighborhood racial and socioeconomic characteristics with neighborhood food availability.” Household median income data from the 2000 Census was used as an indicator of the socioeconomic well-being of a neighborhood in this study. Lopez-Class and Hosler (2010, p.1) state that “Additional contributors to food insecurity stem from the food purchasing pattern for many low-income families...” These studies acknowledge that food insecurity in a community arises from a combination factors amongst which racial/ethnic composition and income are the most significant contributors.

Many CFAs also examine the availability of healthy foods in neighborhood retail outlets—to do so researchers have devised various systems for numerically evaluating the healthiness of a given food retail outlet. In their study assessing the Baltimore city food environment, Haering and Franco (2010) used a system called the Healthy Food Availability Index (HFAI) to assess the quality of the produce and food in a given store. The HFAI system assigns point values to food offerings based on the importance of those food items to the USDA’s recommended daily nutritional requirements. Franco et al. in their 2008 Baltimore CFA also utilize this system as it offers a standard means of categorizing stores based on the quality of their food offerings. This would otherwise be a very difficult task given that foods of the same general type can vary widely in quality based on storage (in the case of fruits and vegetables) or brand (in the case of processed foods).

One of the themes in these CFAs is that there is a discrepancy between the quantity, quality, and price of foods in different store types. This investigating this pattern, like evaluating food quality, is a difficult and nuanced task. However, Haering and Franco (2010) and Franco et al. (2008) use the Standard Industrial Classification (SIC) codes as a basis for their store classifications. Haering and Franco (2010, p.3) state that, “[The SIC] taxonomy does not, however, adequately describe features unique to groups of stores that heavily influence the Baltimore City food environment.”

Haering and Franco (2010), Lopez-Class and Hosler (2010), Franco et al. (2008), and Short, Guthman, and Raskin (2007) all found that low-income areas containing a majority of racial/ethnic

minority residents were more prone to food insecurity. In their San Francisco study Short, Guthman, and Raskin (2007, p.362) were careful to point out about stores in these areas, "...the fact that these stores sell food that is relatively affordable compared to other stores does not necessarily mean that they sell food that is affordable to all low-income residents." These themes echoed repeatedly through the CFAs that we examined and suggest that a successful CFA of Worcester should focus on the connections between income and ethnicity and community food security.

Worcester, Massachusetts is the second largest city in New England and is a well-developed primary transportation hub connecting central Massachusetts to Boston. It is often referred to as "the heart of the Commonwealth" due to its large population and location. This has led to a diverse range of people from different ethnicities, religions and economic backgrounds in a relatively small area. Worcester maintains notable populations of Asians, South Americans, Spanish, Arabic and African Americans. Intermixed with Worcester's 12 undergraduate schools are small businesses, parks, major highways and both urban and suburban communities. Worcester also boasts an estimated 1200 food sources within its boundaries that are supported by both small local farms and large suppliers. Worcester's diverse population, both urban and suburban communities, and complex food system make food security an important issue.

According to the Worcester Food and Active Living Policy Council, "7.1 percent of all households in Massachusetts were food insecure and 2.7 percent reported food insecurity with hunger. This represented an increase from the 1999-2001 reported numbers, when 6.7 percent of households statewide were food insecure and 2.0 percent were food insecure with hunger" (WFALPC, 2006, p. 9). In Worcester, specifically, diet-related diseases suggest food insecurity. The adult obesity rate surpasses the national average and diabetes prevalence is high with 27% of adults in the city obese and 9% of the adult population diabetic (Magee, 2012). Worcester residents also suffer from high rates of other diet-related diseases with 26% of Worcester's adult's hypertensive and 35% reported as having elevated cholesterol. Health problems even more acutely affect the ethnic minority population of Worcester.

The unavailability or high costs of foods used in traditional diets, changes in lifestyle and working conditions, and pressures for integration into a new culture result in dietary modifications, often with negative impacts on health. According to Fitzgerald, "... acculturation and socioeconomic factors are closely related to nutrition and health outcomes. Greater acculturation

among Hispanics (e.g., Mexican Americans) in the United States has been linked to less healthful food intake patterns ... and increases in the prevalence of cigarette smoking, alcohol intake, and obesity” (Fitzgerald, 2010, p. 12). Worcester Food & Active Living Policy Council (WFALPC), “... between 2001 and 2005, there was a 40% increase in number of people served by the food pantries and soup kitchens associated with Worcester County Food Bank” (WFALPC, 2006, p. 9). This indicates that food insecurity has been increasing throughout the years. This is not the only method with which Worcester is trying to combat food insecurity. Worcester has been attempting to initiate numerous policy changes to address this matter, but more information is required by the WFALPC to achieve its goals.

## ***2.5 Worcester Food & Active Living Policy Council***

The mission of the Worcester Advisory Food Policy Council is, “To work with the Worcester community to reduce hunger and increase food security and the overall health of residents of Worcester.” (Castro, Landers & Man, 2012, p.11) They currently focus on the issues of hunger, food security and nutrition center on increasing SNAP enrollment, improving the quality of nutrition in the Worcester Public Schools and initiatives to support farmers’ market food gardens and nutrition classes.

Hunger Free and Healthy is a project of the Worcester Food and Active Living Policy Council. Hunger Free and Healthy was established in 2007, and has developed into a thriving program, helping residents acquire knowledge of healthy food as well as assistance in receiving SNAP benefits. Within the Worcester Public Schools, Hunger Free and Healthy has taken leaps in bounds in improvements when it comes to food. They have improved the schools meals, ensuring that bread products are 90% wheat, and offering a fruit or vegetable at least four days a week. Childhood hunger is a main concern of the Hunger Free and Healthy initiative. 2005 census data states that about 1 in 3 children in the Worcester area lives in a household that at times does not have enough food. (USDA 2011) 80% of children in the Worcester public school system met requirements for free or reduced lunch. (Castro, Landers & Man, 2012, p.9)

Hunger Free and Healthy (HFH) has increased the number of school garden programs within the public school system. This initiative hopes to reconnect teens and young adults back to their food, and to instill a sense of importance of maintaining a healthy diet.

Within the adult community of Worcester, HFH has increased the SNAP participation rate by means of outreach and assisting in filing of application forms. They also have increased the number of farmer markets available to low income neighborhoods, and offered free nutrition-based cooking classes for low-income families (Castro, Landers & Man, 2012, p.17). The farmers' markets are a way to bring healthy and nutritious food into the low-income neighborhoods that otherwise has a difficult time accessing the food they need. In 2011, two new farmers' markets were developed, one in Main South and one in Great Brook Valley.

Much of WFALPC's work has been premised on a hunger-relief model with an emphasis on food assistance and social welfare programs. It is now interested in looking more broadly at access to and availability of food at the community level, which focuses on food flows into communities, the connections between consumption and the local and regional food system, and social inequalities in the system.



### 3. Methodology

The goal of our project was to aid the Worcester Food and Active Living Policy Council in assessing the food security of low-income residents in specific neighborhoods of Worcester in order to help policy makers understand how low-income residents are affected and cope with food access and availability. The project provided food policy-makers with resources such as maps and spatial analyses of Worcester's food security, residents' perceptions of the local food system, and a set of recommendations for addressing food insecurity.

Our primary objectives are as follows:

- a) Analyzing spatial and social dimensions of food security.
- b) Devising an appropriate measure of healthy food availability, quality and price.
- c) Understanding the perceptions of local residents about the workings of the food system and steps to improve it.

#### 3.1 *Analyzing Spatial Dimensions of Food Security*

Our study utilized a geographic information system (GIS) to represent and analyze the spatial characteristics of food security in Worcester. The issues considered in this analysis were: location of food sources by type (e.g. supermarkets, corner stores, and fast food), availability of healthy foods, food prices, available transportation options, as well as socioeconomic variables from the 2010 census, such as household income, race, and ethnicity. We utilized GIS to depict this information as point data, choropleth maps, and layers.

#### **Identifying target neighborhoods**

With the help of our sponsor we initially identified four neighborhoods for our food assessment: Grafton Hill, South Main Street, Lincoln Street, and Great Brook Valley. Of these neighborhoods, Lincoln Street and Great Brook Valley form a continuous geographical area, but will be treated separately in analysis of socio-economic data due to ethnic differences. To determine if these neighborhoods were among Worcester's most disadvantaged, we used Census 2000 median household income. Our spatial analysis was focused on food access and availability issues in the four neighborhoods. We define food availability as having sufficient quantities of healthy and culturally appropriate foods available on a consistent basis. Food access was defined as having sufficient

means (money, child care for leaving the house, access to transportation) to obtain appropriate and nutritious foods based on the location of houses to retail food outlets within a reasonable distance. Variables that influence food access and availability include income level, distance from food retail outlets, food pricing at those outlets, and access to healthy and culturally appropriate foods

### **Estimating Access to Retail Outlets**

Access to healthy food was determined by drawing a 1/2 and one mile buffer around block group centroids of the four surveyed neighborhoods. The buffer radii represent walkable distances for food shopping. Following Ver Ploeg (2009, p.19) walkability is characterized as: high (distance less than 0.5 miles), medium (distance from 0.5-1 mile), or low (distance greater than 1 mile—we used a radius of 0.5 miles).

The locations of supermarkets in the city, widely seen as the most reliable sources of healthy food, were plotted in GIS. This spatial relationship was used to judge food access. Buffers were established around each supermarket in the city corresponding to the walkability evaluation discussed by Ver Ploeg (2009). The supermarkets considered were not restricted solely to the neighborhood block groups, but also included one supermarket outside of the city for the purposes of comparing it to other supermarkets within the city.

### ***3.2 Measuring of Food Availability, Quality and Price***

In order to gain an understanding of how food quality, availability and pricing influence Worcester's local food security, we examined the following questions.

- 1) How do we classify food outlets in Worcester?
- 2) How can we devise an index that would enable us to assess healthy food availability in retail outlets and what would a Healthy Food Availability Index (HFAI) of Worcester look like?
- 3) How should general food availability and pricing be collected?

### **Classifying Food Sources**

In order to classify different food retail outlets, we chose to use the Department of Labor's Occupational Safety and Health Administration's two digit Standard Industrial Classification (SIC)

system (SIC Division Structure). This system offers concrete classifications for food outlets and explanations as to their classifications. Below are the SIC codes we used in this study:

- 5399- Miscellaneous Retail: Establishments primarily engaged in the retail sale of a general line of apparel, dry goods, hardware, house wares or home furnishings, groceries, and other lines in limited amounts. Stores selling commodities covered in the definition for department stores, but normally having less than 50 employees, and stores usually known as country general stores are included in this industry. Establishments primarily engaged in the retail sale of merchandise by television, catalog and mail-order are classified in Industry 5961.
- 5411- Supermarkets: Defined as stores, commonly known as supermarkets, food stores, and grocery stores, primarily engaged in the retail of all sorts of canned foods and dry goods, such as tea, coffee, spices, sugar and flour, fresh fruits and vegetables; and fresh prepared meats, fish and poultry.
- 5499- Ethnic Food Stores and Non-Ethnic Corner Stores: Establishments primarily engaged in the retail sale of specialized foods, not elsewhere classified, such as eggs, poultry, health foods, spices, herbs, coffee and tea. The poultry stores may sell live poultry, slaughter and clean poultry of their own account, and sell dressed fowls, or sell fowls cleaned and dressed by others
- 5541- Gas/Convenience Service Stations: Gasoline service stations primarily engaged in selling gasoline and lubricating oils. These establishments frequently sell other merchandise such as tires, batteries, other automobile parts and perform minor repair work. Gasoline stations combined with other activities, such as grocery stores, convenience stores, or carwashes, are classified according to the primary activity.
- 5812- Restaurants/Fast Food Places: Establishments primarily engaged in the retail of prepared food and drinks for on-premise or immediate consumption, to include fast food restaurants. Caterers and industrial food service establishments are also included in this industry.

This system of classifying sources along with the addresses of all places in Worcester that have food permits, allowed us to locate and classify any source. The addresses of all food sources in Worcester were provided by the Department of Health and Human Services for a small fee.

According to this data there were over 1250 food sources in Worcester that were registered with the local government. After filtering the data by eliminating seasonal sources, fraternities, food suppliers such as Sysco and other extraneous food outlets, we isolated the outlets that fell within our selected boundaries. Over 120 food outlets remained within Main South, Grafton Hill, Lincoln Street and Great Brook Valley. The addresses of the remaining food outlets were converted to latitude and longitude via Google Maps and imputed into Microsoft Excel for GIS interpretation. Of the food outlets mapped, every location was verified and approximately 47 outlets were surveyed for healthy food availability index and pricing. Every food outlet that wasn't a restaurant within our sponsor's areas of interest was surveyed.

### **Establishing a Healthy Food Index**

This project chose to measure the availability of healthy food with the Nutritional Environment Measurement Survey's (NEMS) Healthy Food Availability Index (HFAI) (Glanz, Clawson & Carvalho, 2006). This index uses certain standards of healthy food and a point system to establish a clear-cut, numerical evaluation of each food source's availability of healthy food. NEMS provided a very detailed HFAI that included many foods not common to Worcester or were seasonal. Our study created a HFAI uniquely tailored to Worcester to provide a better measure and receive more accurate results. Our HFAI was modified to prefer foods common to Worcester and favor healthy foods based on the composition of a healthy diet as recommended by the USDA's healthy food plate. As an example healthy grains carried more numerical weight than healthy dairy options because they should be a larger percentage of a healthy diet as recommended by the USDA than dairy. Located on the next page is an example of a store evaluation.

Food Group	Healthy Score	Availability Score
<u>Dairy:</u> A) Milk B) Cheese C) Yogurt	A) 1% or Skim Milk=1pt B) Organic/Low Fat=1pt C) Organic Brand=1pt	A) >25% =1pt, >50%=2pts B) >2 Brands=1pt C) >2 Brands=1pt
<u>Fresh Fruits:</u> A) All Fruits	A) Seasonal or Organic Fruit =1pt	A) >20 types=1pts, >40 types=2pts, >50 types=3pts
<u>Fresh Vegetables:</u> A) All Vegetables	A) Seasonal or Organic Vegetables=1pt	A) >20 types=1pts, >40 types=2pts, >50 types=3pts
<u>Meats:</u> A) Chicken B) Ground Beef	A) Skinless Breast=1pt B) 90% Lean Beef=2pts	A) >20%=1pt, >35%=2pts B) >20%=1pt, >35%=2pts
<u>Grains:</u> A) Bread B) Pasta C) Rice D) Cereal	A) Whole Grain Bread=2pts B) Whole Grain Pasta=2pts C) Brown Rice=2pts D) Whole Grain Cereal=2pts	A) >2 Brands=2pts B) >3Brands=2pts C) >2Brands=2pts D) >4 Brands=2pts
<u>Beverages:</u> A) Soda B) Juice	A) Diet Soda=1pt B) 100% Fruit Juice=1pt	A) Eye/Chest Level=1pt B) Eye/Chest Level=1pt
<u>Healthy Alternative:</u> A) Bacon B) Potato Chips	A) Turkey Bacon=2pt B) Baked Potato Chips=2pts	A) >2 Brands=1pt B) Eye/Chest Level=1pt
<u>Source Name:</u> Store "X" Source SIC: ex.9999 Total Score:48 (MAX)	Healthy Score: 22 (MAX)	Availability Score: 26 (MAX)

## **Collecting Food Availability and Pricing Data**

Collecting food availability and pricing data was done with a simple checklist. This checklist contained a line for each food specified above with a “yes” box indicating the food can be purchased from that source, a “no” box indicating that the food could not be purchased from that source and a “price” line that has the price per unit of measurement specified in the chart above. This checklist method allow for multiple types of data to be collected at the same time, is easy to understand and repeat. Appendix F contains the checklist used to collect pricing data at each source. We will supplement our numerical data with qualitative interview data from resident interviews.

### ***3.3 Conducting Interviews to Understand Perceptions***

Understanding the social aspects of food justice and food security is vital to our project so that we may be able to see how residents think about options and make decisions concerning where they shop, what they buy and how they cook. We also can see in what ways their perceptions, decisions, actions, and routines are shaped in response to resources and neighborhood contexts.

We focused on low-income residents of the Worcester area. According to Nord (Nord, 2005) and Cohen (Cohen, 2010) residents of low-income neighborhoods are likely to be more vulnerable to food insecurity. Our sponsor, the Worcester Food Policy and Active Living Council, identified low income and ethnic minority interviewees. We conducted 10 semi-structured interviews in both English and Spanish (see Appendix A for a list of our questions). We asked the interviewees to discuss how they navigate the local food system and to tell us how they make decisions about where they shop, what they buy, and if they have access to culturally appropriate foods. “The purpose of such interviews is not to identify what is ‘the truth’ but to help the researcher understand the experiences and lives of the participants and the conclusions the participants themselves have drawn from them.”(Doyle, 2006, p.239) The biggest advantage of qualitative interviews is the ability to get to know the people our project is about, and the rich information we can acquire through their personal experiences.

The specific issues we targeted were: understanding obstacles to obtaining desired ethnic foods, the social and psychological distance to acceptable sources of food; the amount of available healthy foods; and how residents address these issues. Secondary issues that we considered are: residents’ safety concerns, the efficacy of government assistance programs, and access to food banks

and soup kitchens. Following suggestions from sources such as the Community Food Assessment Toolkit we developed the following interview questions and data collection form (Cohen 2002 pp. 15-19, 56).

## 4. Findings

### 4.1 *Spatial analyses of food access, availability, quality and price*

Our project examined the spatial relationships between food retail outlets<sup>1</sup> and ethnicity and income at the block group level in selected Worcester neighborhoods—Grafton Hill, Great Brook Valley, Lincoln St., and Main South. Here, we use the term food retail outlets as stores which specialize in selling food ingredients (restaurants are excluded from this definition). The findings below reveal both the spatial variation in the availability of healthy food in Worcester as well as the accessibility to retail outlets

**FINDING 1: Compared to corner stores, bodegas, and convenience stores, Worcester supermarkets offer a greater variety of healthy foods**

Average HFAI	
Type	HFAI
Misc. Retail (SIC: 5399)	9.4
Supermarkets (SIC: 5411)	36
Gas and Convenience (SIC: 5541)	8.5
Ethnic and Corner Stores (SIC: 5499)	8.8
Spanish	10.2
African	4.7
Asian	13.7
Arabic	6.5

**Table 2: Average Food Retail Outlet HFAI Scores by SIC Code**

Our HFAI data was obtained for 43 of the 145 food stores in Worcester. Using our data we calculated average HFAIs for each of the store types and imputed those values for stores that we did

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<sup>1</sup> Gas and convenience stores and stores from the miscellaneous food retail store category were not crucial food sources in our study. We created ethnic composition maps as well as median household income maps with respect to store locations for these categories as well. Those maps can be found in Appendix E.



not survey. HFAI scores were broken into three equal intervals and block groups were classified according to average HFAI value of the stores contained within. Our results suggest that the majority of block groups in Worcester have a low HFAI score. We also investigated the relationship between fast food restaurant locations and ethnicity and income of block groups.

Using SIC code classifications, we categorized all licensed food retail outlets in the city of Worcester. Since not every food retail outlet in the city could be surveyed given time and resource constraints, HFAI scores for non-surveyed food retail outlets were imputed. To do this, average HFAI scores for each classification were found within our sample and these values were then applied to stores that were not surveyed. Table 2 contains the previously mentioned average scores.

As Table 2 shows supermarkets in Worcester have an average HFAI score of 36, compared to 8.8 for an ethnic or corner store. Other store types scored roughly the same with gas and convenience stores scoring lower than all other types. Stores that were part of the same chain tended to score similarly regardless of their location.

**FINDING 2: Neighborhoods that are predominantly white (>60%) are more likely to have access to food retail outlets that sell high quality and nutritious food.**

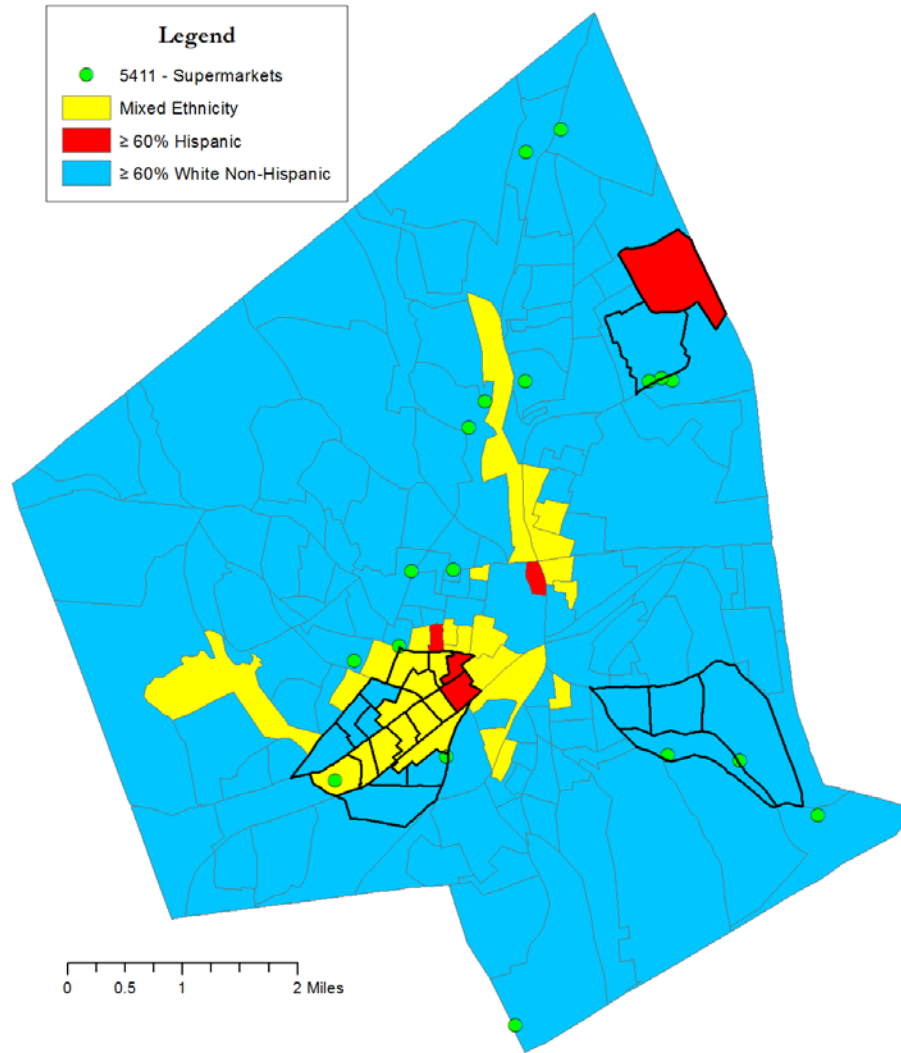


Figure 4: Block Group Ethnic Composition and Supermarket Locations in Worcester

### Type of Food Store

	% Supermarkets
Total	17
Block Group Ethnic Composition*	
White	94.12%
Hispanic	0%
Mixed	5.88%

\*Ethnic composition of block groups determined as white if  $\geq 60\%$  of the residents were white, Hispanic if  $\geq 60\%$  of residents where Hispanic. All remaining neighborhoods classified as mixed.

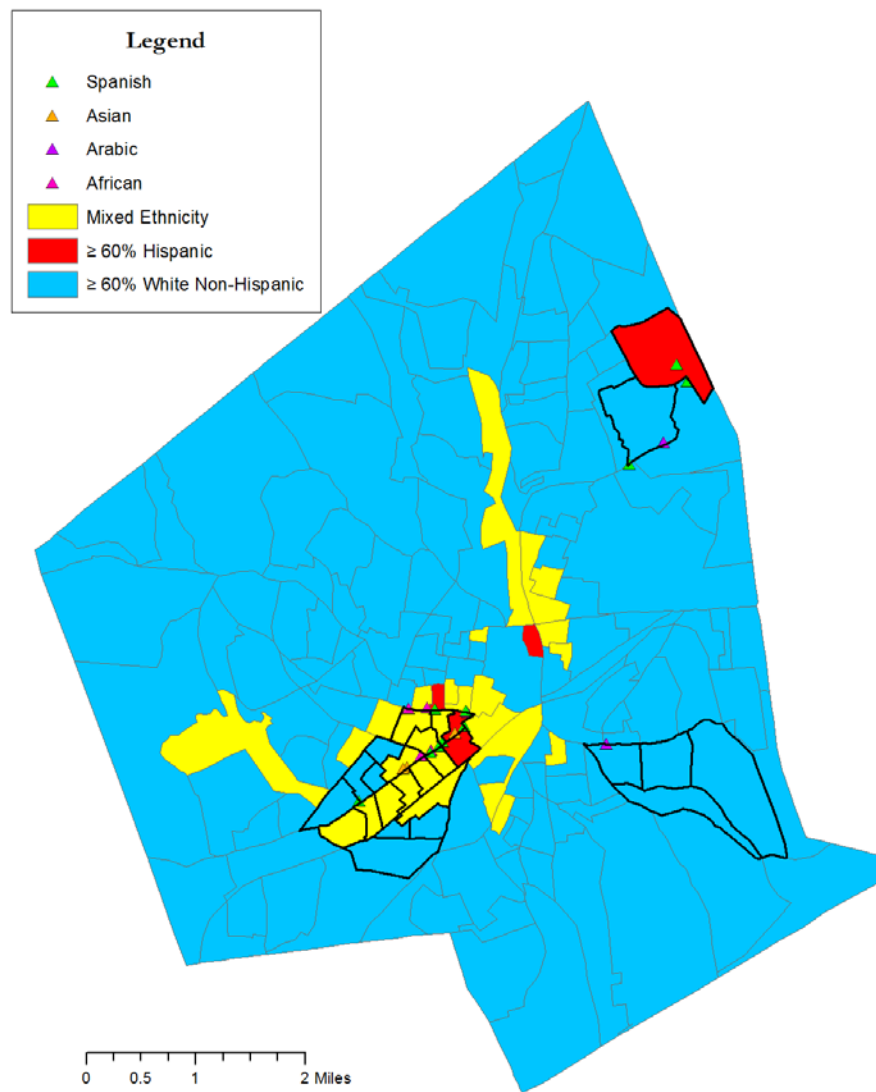
**Table 3: Distribution of Supermarkets in Worcester with Respect to Block Group Ethnic Composition**

Following Haering and Franco (2010) we defined predominantly Hispanic block groups as those where  $\geq 60\%$  of the population is Hispanic, predominantly non-Hispanic white block groups are those where  $\geq 60\%$  of the population is white, and ethnically mixed block groups as those which do not fit into the other two categories. We found that supermarkets in the city of Worcester were far more likely to earn a high HFAI score than any other type of store. Figure 4 shows the distribution of supermarkets with respect to ethnic composition of block groups. It is clear that most Worcester supermarkets lie within block groups that are predominantly white. Out of the 17 supermarkets in the city, 5 lie within the neighborhoods that we surveyed. Only one supermarket lies in a mixed block group and no supermarkets lie within Hispanic block groups. This is significant because it tells us that supermarkets, which have large selections of healthy foods, are most frequently located in white block groups as opposed to Hispanic or mixed ethnicity block groups.

As Table 3 indicates, 94.12% of all supermarkets in the city are located in block groups that are predominantly non-Hispanic white<sup>2</sup>. Ethnically mixed block groups contain 5.88% of the total number of supermarkets in the city. Hispanic block groups do not contain any supermarkets, nor do they contain any stores which are classified as having a high HFAI.

<sup>2</sup> Census data classifies white and white Hispanic groups separately.

**FINDING 3: Hispanic and ethnically mixed neighborhoods have access to some 50 ethnic groceries and corner stores, with much of this variety centered in Main South.**



**Figure 5: Block Group Composition and Ethnic Grocery Locations in Surveyed Neighborhoods**

### Type of Food Store

	% Ethnic Groceries and Non-Ethnic Corner Stores
Total	49
Block Group Ethnic Composition*	
White	46.94%
Hispanic	10.2%
Mixed	42.86%

\*Ethnic composition of block groups determined as white if  $\geq 60\%$  of the residents were white, Hispanic if  $\geq 60\%$  of residents were Hispanic. All remaining neighborhoods classified as mixed.

**Table 4: Distribution of Ethnic Groceries and Non-Ethnic Corner Stores in Worcester with Respect to Block Group Ethnic Composition**

Ethnic groceries are a source of culturally appropriate foods for many of Worcester's ethnic minority residents, offering items that would otherwise be unavailable. We plotted locations for ethnic groceries only within the four neighborhoods surveyed by our study. This decision was made to ensure that all food retail outlets classified as ethnic groceries were properly categorized. For the entirety of Worcester, corner stores and ethnic groceries were combined into a single classification.

Figure 5 shows that the Main South neighborhood contains the largest number and variety of ethnic groceries out of the four neighborhoods surveyed. Grafton Hill contains a single ethnic grocery despite its relatively large size. The Lincoln Street neighborhood contains two ethnic groceries, as does Great Brook Valley. Figure 5 also shows that block groups within the neighborhoods that we surveyed that were either Hispanic or of mixed ethnicity were much more likely to contain an ethnic grocery. For example in the Main South neighborhood, the most ethnically diverse of the neighborhoods that we surveyed, there is an equally diverse selection of ethnic groceries.

**FINDING 4:** Supermarkets in Worcester are more likely to be located in high and low income neighborhoods, suggesting a higher degree of food availability in those areas

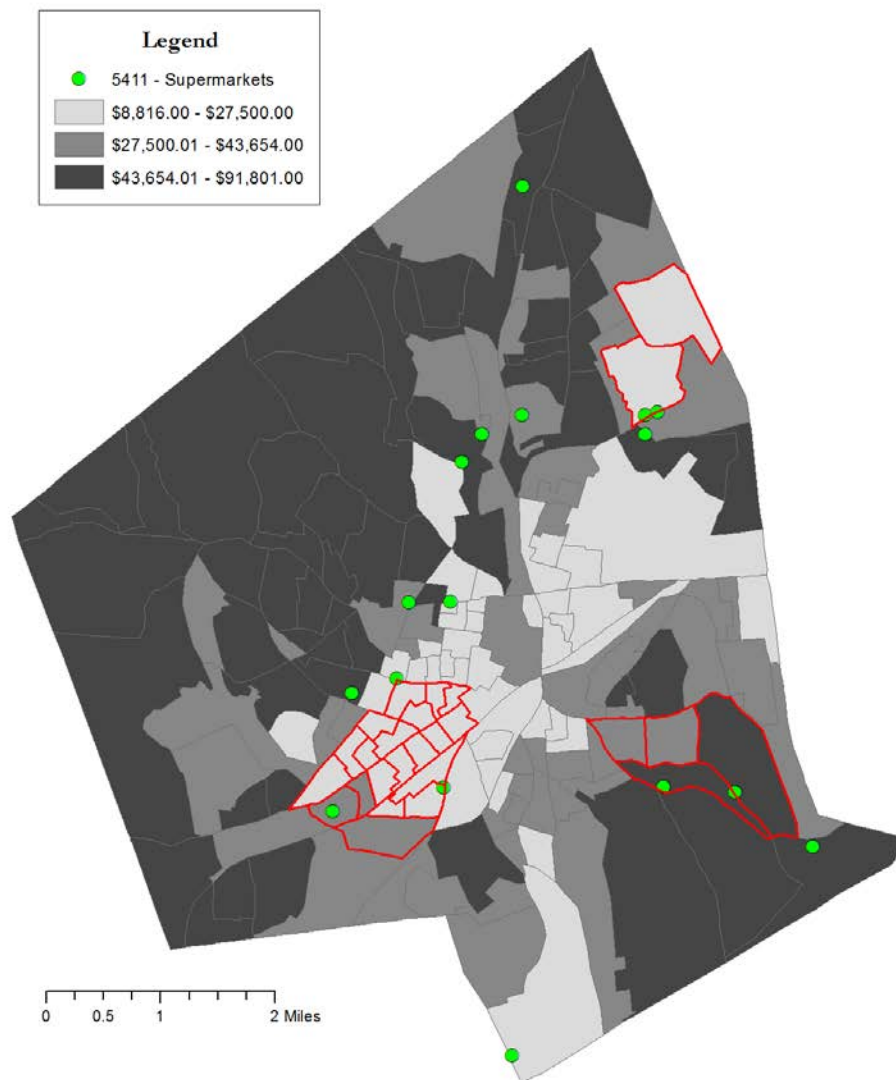


Figure 6: Block Group Household Median Income and Supermarket Locations in Worcester

### Type of Food Store

	% Supermarkets
Total	17
Block Group Income* *	
Low	35.29%
Medium	17.65%
High	47.06%

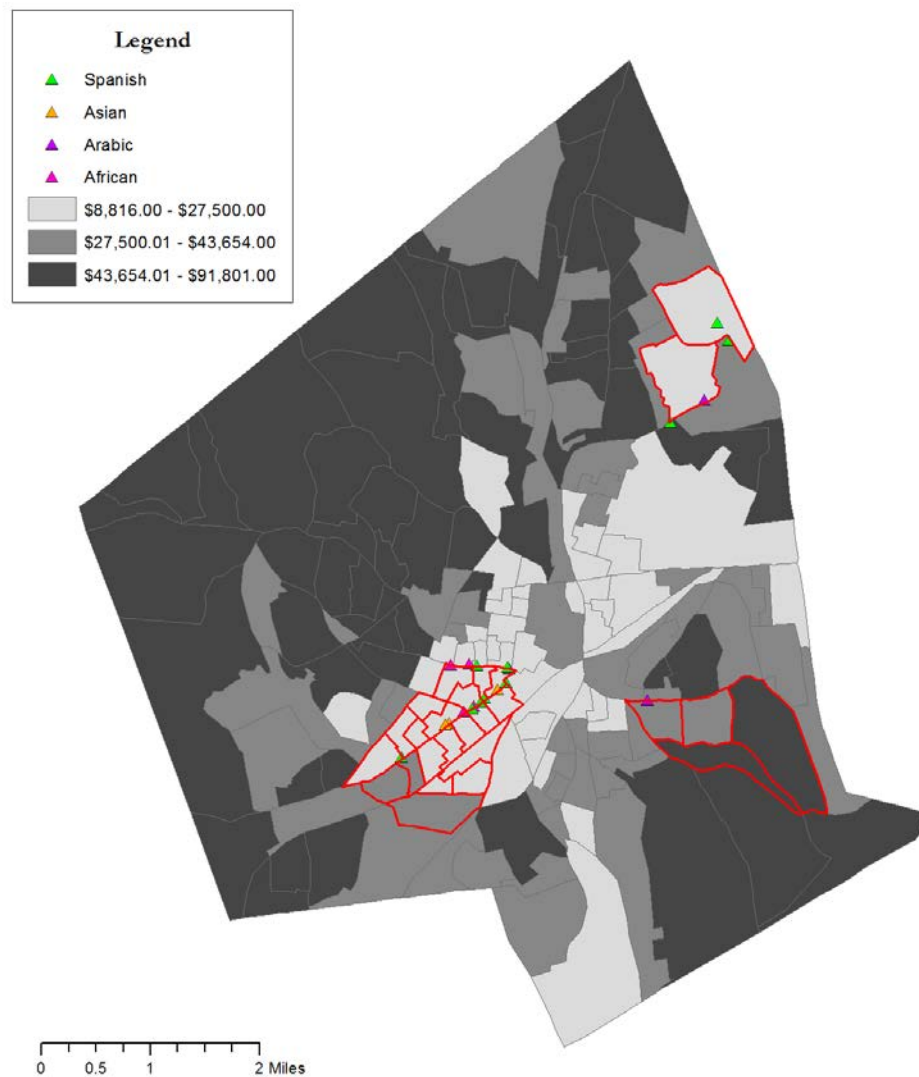
\*\*Block group income was broken up into tertiles. Those is the lowest third were classified as low, those in the middle third as medium, and those in the highest third as high.

**Table 5: Supermarket Distribution with Respect to Block Group Median Household Income**

Figure 6 shows the spatial distribution of supermarkets in Worcester against median household income. This distribution shows that the Great Brook Valley neighborhood was the only surveyed neighborhood not found to contain a supermarket. Additionally, it shows that that block groups in the highest and lowest tertiles of median income are more likely to contain a supermarket than block groups in the medium tertile for this variable.

Referring to Table 5, we can see that high-income block groups, those with a median household income ranging from roughly \$43,000 to \$91,000 contain 47.06% of Worcester's supermarkets. Medium-income block groups, those with median household incomes between \$27,500 and \$43,000 contain 17.65% of the city's supermarkets, whereas low-income block groups with incomes ranging from \$8,816 to \$27,500 contain 35.29% of the city's supermarkets. The trend is much different from what was observed when supermarket locations were plotted against ethnicity. The data suggest a weaker relationship between block group income and supermarket locations than the relationship observed between ethnic composition and supermarket locations.

**FINDING 5: Block groups with lower median household incomes are more likely to contain an ethnic grocery or corner store**



**Figure 7: Block Group Household Median Income and Ethnic Grocery Locations in Surveyed Neighborhoods**



### Type of Food Store

	% Ethnic Groceries and Non-Ethnic Corner Stores
Total	49
Block Group Income* *	
Low	59.18%
Medium	20.41%
High	20.41%

\*\*Block group income was broken up into tertiles. Those is the lowest third were classified as low, those in the middle third as medium, and those in the highest third as high.

**Table 6: Ethnic Grocery Distribution with Respect to Block Group Median Household Income**

In Figure 7 we plotted ethnic grocery locations in the four neighborhoods we surveyed, in relation to household median income.

Figure 7 shows that that within the neighborhoods that we surveyed, only one ethnic grocery in Grafton Hill is not located in a block group belonging to the lowest tertile of median household income. In every other instance, these stores are located in low-income block groups.

Table 6 depicts the distribution of ethnic groceries and non-ethnic corner stores in the city. Low-income block groups, on the other hand, contain 59.18% of the total number of these stores. This establishes a clear connection between the income level of a block group and the likelihood of that block group to contain an ethnic grocery or non-ethnic corner store.

**FINDING 6: White block groups are more likely to contain food retail outlets with a high HFAI score**

Healthy Food Availability Index			
	% low	% medium	% high
Total	126	4	15
Block Group Ethnic Composition			
White	65.33%	50%	93.33%
Hispanic	7.69%	25%	0%
Mixed	26.98%	25%	6.67%

**Table 7: Food Retail Outlet HFAI Distribution with Respect to Block Group Ethnic Composition**

We categorized food retail outlets as having either a high HFAI score, a medium HFAI score, or a low HFAI score by breaking the range of scores into three equal intervals. Table 7 shows the results. Of the 15 high HFAI outlets, we found that 93.33% are located in predominantly white block groups. Predominantly Hispanic and ethnically mixed block groups contain 0% and 6.67% of these outlets, respectively. Few outlets fell into the medium HFAI score category, while 126 fell into the low score category. Of the 126 outlets which earned low HFAI scores, we found that 65.33% are located in white block groups, 7.69% are located in Hispanic block groups, and 26.98% are located in ethnically mixed block groups.

From this we can see that this is a disparity between the number of high HFAI outlets located in white block groups compared to the number of low HFAI outlets found in these block groups. This difference suggests that white block groups host a disproportionately large number of high HFAI outlets whereas Hispanic block groups contain no outlets of this type and ethnically mixed block groups contain a much higher percentage of low scoring outlets compared to their share of high scoring outlets.

**FINDING 7: Block groups with high median household incomes are more likely to contain food retail outlets with high HFAI scores and less likely to contain ones with low HFAI scores**

Healthy Food Availability Index				
	Worcester	% low	% medium	% high
Total	145	126	4	15
Block Group Income				
Low	73	51.11%	100%	20%
Medium	40	28.57%	0%	26.67%
High	32	19.84%	0%	53.33%

**Table 8: Food Retail Outlet HFAI Distribution with Respect to Block Group Median Household Income**

We classified block groups in Worcester according median household income tertile and examined the distribution of food retail outlet HFAI scores as shown in Table 8. We found that 53.33% of the outlets classified as having a high HFAI are located in high income block groups while 19.84% of the outlets classified as having a low HFAI score are located in these block groups. We found that low income block groups contain 51.11% of the low HFAI outlets in the city while they contain only 20% of the high HFAI outlets.

The trend shown in Table 8 suggests that block group income affects the HFAI scores of food retail outlets within a given block group with a disproportionately high percentage of high HFAI score outlets being located in high income block groups and a disproportionately high percentage of low HFAI score outlets being located in low income block groups meaning people living in low income block groups have a lower degree of access to healthy foods.

**FINDING 8: Most fast food restaurants in Worcester are located along major transportation routes and in neighborhoods that are predominantly white**

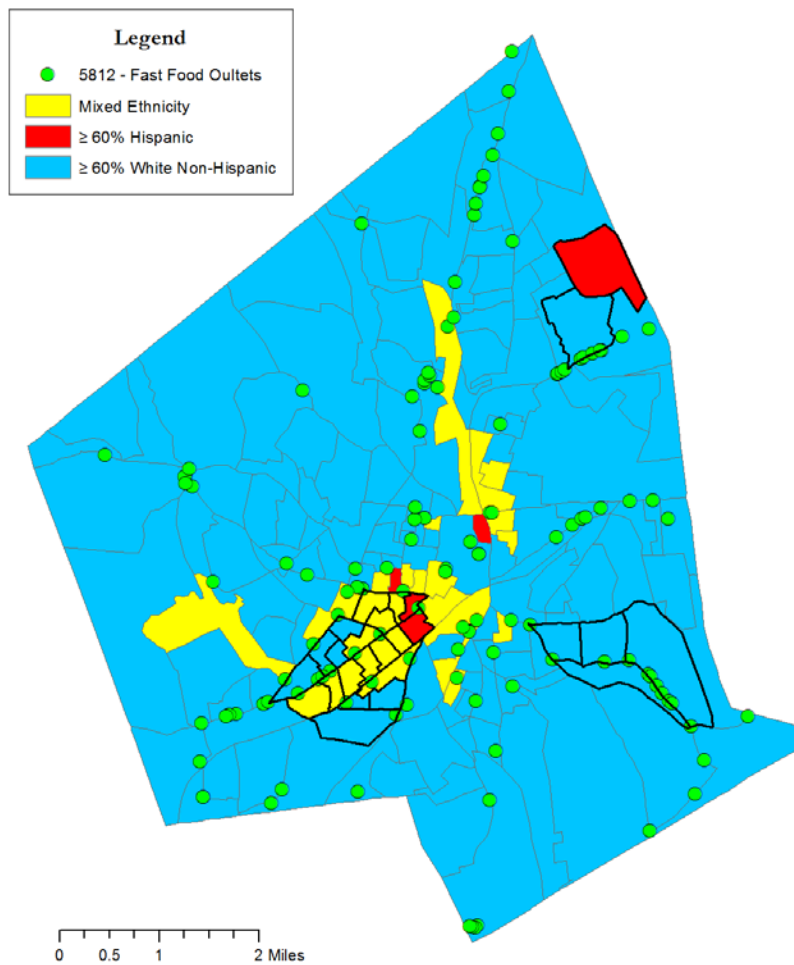


Figure 8: Block Group Ethnic Composition and Fast Food Restaurant Locations in Worcester

### Type of Food Store

	% Fast Food
Total	133
Block Group Ethnic Composition*	
White	87.21%
Hispanic	0.76%
Mixed	12.03%

\*Ethnic composition of block groups determined as white if  $\geq 60\%$  of the residents were white, Hispanic if  $\geq 60\%$  of residents where Hispanic. All remaining neighborhoods classified as mixed.

Table 9: Fast Food Restaurant Distribution with Respect to Block Group Ethnic Composition

Figure 8 shows the distribution of fast food restaurants in the city with respect to ethnicity at the census block group level. The majority of fast food restaurants are located in predominantly white block groups with a total of two located in Hispanic block groups. Table 9 shows that of the 133 fast food restaurants in the city 87.21% of them are located in white block groups. Ethnically mixed block groups contain only 12.03% while only one fast food restaurant is located in a predominantly Hispanic block group.

Figure 8 shows clustering of fast food restaurants occurs around major thoroughfares such as I-290. This distribution suggests that Hispanic and mixed block groups are not inherently more vulnerable to fast food consumption patterns based on restaurant location alone.

**FINDING 9: A Large Portion of Surveyed Neighborhoods Lie within Walking Distance of a Supermarket**

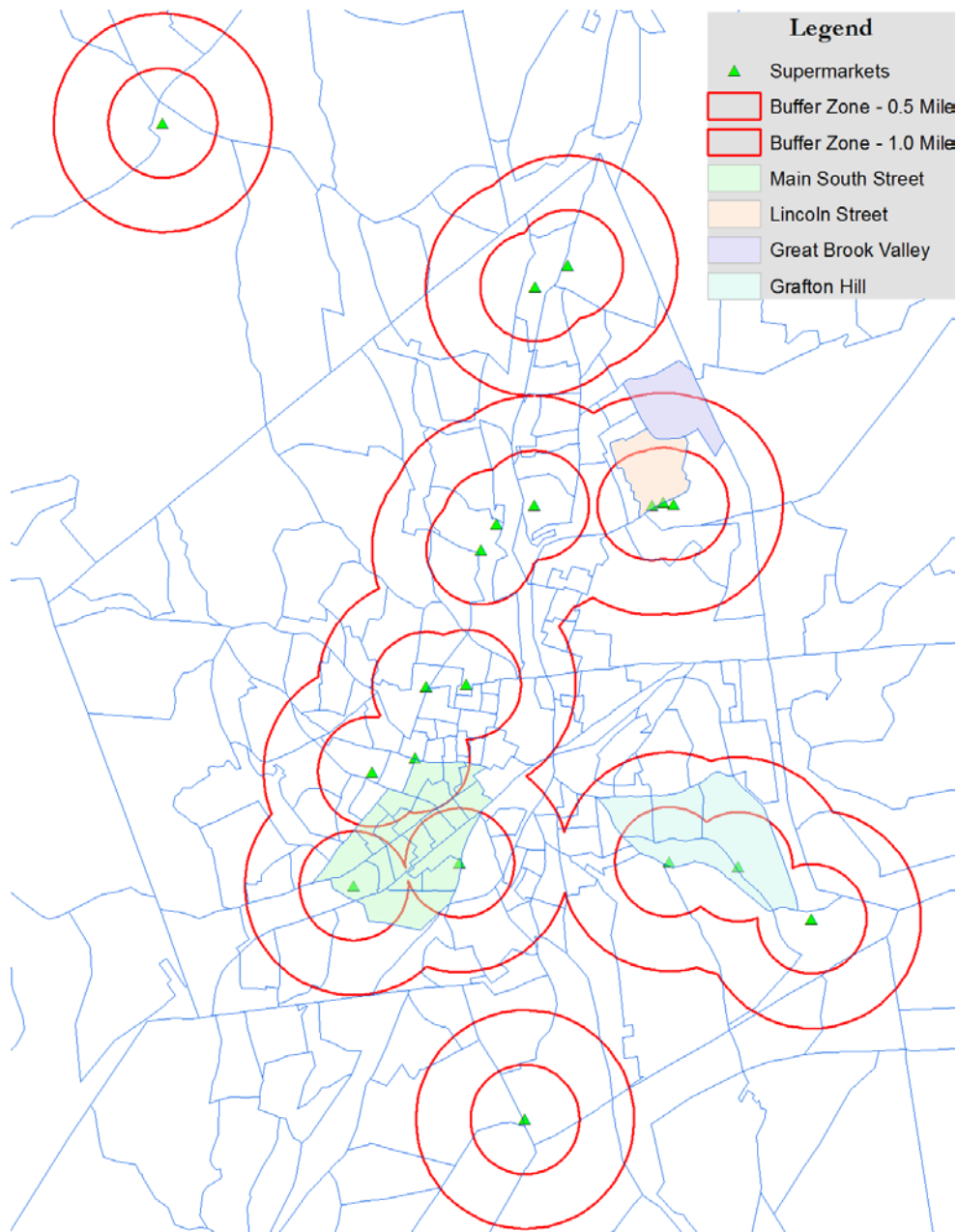


Figure 9: Supermarket Locations in Worcester with Walkability Buffers

An important factor in assessing food access in a city is whether or not residents are located within walking distance of food retail outlets offering a wide selection of healthy foods of a reasonable quality. Previous studies, as mentioned in our methods section, have employed a definition of walkability to help analyze this situation. Given how cumbersome it can be to carry shopping on foot, residents are generally unwilling to walk more than 1 mile each way to shop for food and prefer to walk less than 0.5 miles. For our purposes, high walkability means that residents live less than 0.5 miles from a supermarket, medium walkability is 0.5 mile and 1 mile from a supermarket and low walkability refers to supermarkets greater than 1 mile away.

Figure 9 shows that three of the four surveyed neighborhoods lie in areas of either medium or high walkability in regard to supermarkets. The one exception, Great Brook Valley, lies mostly within a medium walkability range. Figure 9 suggests that the surveyed neighborhoods have good access to supermarkets, the food retail outlets with the highest HFAI scores. However, other factors must be considered in examining access to healthy foods. For example, elderly residents and residents with physical disabilities are not accounted for by a simple study of walkability. A high walkability implies only that residents have an additional transportation method available.

## FINDING 10: Supermarkets offer lower overall average prices than corner stores

### Avg. Market Basket Prices

Categories	Cost	
	Corner Stores	Supermarkets
Beef per lb.	\$3.99	\$3.87
Breast per lb.	\$3.14	\$3.26
Bread per loaf	\$2.89	\$2.15
White Rice	\$1.80	\$0.86
Pasta	\$1.61	\$1.35
Cereal	\$4.18	\$2.00
Corn	\$3.29	\$2.99
Potatoes	\$2.60	\$1.03
Broccoli	\$1.59	\$1.71
Carrots	\$1.72	\$1.06
Apples	\$1.80	\$1.44
Bananas	\$1.12	\$0.73
Oranges	\$1.62	\$1.02
Grapes	\$3.29	\$2.57
Eggs	\$2.05	\$2.13
Milk	\$3.53	\$3.31
Cheese	\$4.52	\$3.62
Yogurt	\$1.59	\$1.61

Table 10: Average Market Basket Prices of Corner Stores in Comparison to Supermarkets

Using the pricing data collected from the supermarkets and corner stores that we surveyed, we calculated average prices for common foods and compared these averages between the corner stores and supermarkets as shown in Table 10. We found that neither type of food retail outlet sold food at lower prices overall. Corner stores prices were found to be slightly lower for a number of foods; for example the average price for a pound of chicken breast in the corner stores surveyed was \$3.14 compared to an average price of \$3.26 at the supermarkets we surveyed. However, the average supermarket price, when it was lower, was found to be significantly lower. An example of this pattern is the difference seen with potatoes. Potatoes cost an average of \$2.60 per pound in the corner stores we surveyed. The supermarket price was less than half this at \$1.03 per pound. White



rice was also significantly less expensive in supermarkets than in corner stores with supermarkets charging an average of \$0.86 per pound and corner stores charging an average of \$1.80 per pound.

Overall, prices in surveyed supermarkets were lower than those in surveyed corner stores for the food items that comprise our market basket. Food prices are an important consideration because they affect the ability of a family to adequately feed itself. The average price results from our market basket suggest that supermarkets provide a better overall shopping environment than corner stores for city residents given the variety of foods available and the generally lower prices of these foods.

## FINDINGS SUMMARY & CONCLUSIONS

	# Stores in Neighborhoods and Block Groups					Healthy Food Availability Index			Types of Food Stores				
	Worcester	Main South Street	Lincoln Street	Grafton Hill	Great Brook Valley	% low	% medium	% high	% Supermarkets	% Gas / Convenience	% Ethnic Groceries and Non-Ethnic Corner Stores	% Misc. Retail	% Fast Food
Total	145	23	7	11	2	126	4	15	17	49	49	30	133
*Block Group Ethnic Composition													
White	102	6	7	11	1	65.33%	50%	93.33%	94.12%	81.63%	46.94%	76.67%	87.21%
Hispanic	5	2	0	0	1	7.69%	25%	0%	0%	0%	10.2%	0.0%	0.76%
Mixed	38	15	0	0	0	26.98%	25%	6.67%	5.88%	18.37%	42.86%	23.33%	12.03%
**Block Group Income													
Low	73	23	4	0	1	51.11%	100%	20%	35.29%	38.78%	59.18%	30%	33.83%
Medium	40	0	3	7	1	28.57%	0%	26.67%	17.65%	38.78%	20.41%	43.33%	30.82%
High	32	0	0	4	0	19.84%	0%	53.33%	47.06%	22.45%	20.41%	26.67%	35.33%

\*Ethnic composition of block groups determined as white if ≥60% of the residents were white, Hispanic if ≥60% of residents were Hispanic. All remaining neighborhoods classified as mixed.

\*\*Block group income was broken up into tertiles. Those in the lowest third were classified as low, those in the middle third as medium, and those in the highest third as high.

**Table 11: Summary Table of Worcester**

Table 11 summarizes the distribution of food retail outlets in the city as well as the HFAI scores for those outlets. We can conclude from Table 11 that predominantly white block groups contain the vast majority of high HFAI stores with 93.33% of the total. However, white block groups contain only 65.33% of the total number of low HFAI stores in the city. This disparity can be mostly attributed to the fact that white block groups contain 94.12% of the supermarkets in the

city and supermarket form the bulk of high HFAI food retail outlets with, looking at Table 11, an average HFAI score of 36.

Hispanic block groups contain 0% of the high HFAI outlets in the city, 25% of the medium HFAI outlets and 7.69% of the low HFAI outlets. This suggests that Hispanic block groups have lower immediate access to healthy foods. This in turn makes it more likely that residents living in Hispanic block groups will be forced to cope with overcoming more barriers to obtaining healthy food when compared to residents living in predominantly white block groups.

Ethnically mixed block groups contain 26.98% of low HFAI outlets, 25% of medium HFAI outlets, and 6.67% of all high HFAI outlets. This implies that, like ethnically Hispanic block groups, ethnically mixed block groups experience a lower degree of immediate food access when compared to white block groups. A similar trend emerged where low income block groups tend to experience a lower degree of immediate food access compared to other block groups.

It must be added that the presence of high HFAI stores in a block group or neighborhood does not guarantee food security. To guarantee food security, residents must not only be proximate to food retail outlets, but must have the time and flexibility to shop for necessary healthy foods. For example, residents living in areas without a nearby supermarket may not have the option of walking to purchase groceries, but they may have a higher income and, as a result, more flexibility to find child care, drive to other outlets inside of and outside of the city, etc.

## ***4.2 Household Strategies to Address Food Security***

Our interviews complement our quantitative analysis on food access and availability. The interviews focused on the factors residents take into account when they shop for food—price, proximity, quality, time. Throughout our interviews, we were able to connect with low income and minority Worcester residents in order to understand the workings of the food system from their perspectives. In broad terms we discussed challenges to buying desired ethnic foods, how notions of safety and the built environment influenced their choices as to where to shop, their use of buses and private transportation to increase access to more attractive shops, and issues related to cost versus food quality. We also discussed the efficacy of the Supplemental Nutrition Assistance Program (SNAP).

We conducted 3 semi-structured group interviews, one in the Worcester Advisory Food Policy Council office, one in Plumley Village health care center, and one in Great Brook Valley's Boy's and Girl's club. The interviews were recorded for strictly note-taking purposes and will never be used for republication. The group sizes ranged from 2-5. Our interviewees were representative of a very large immigrant population. The ethnicities included Hispanic, Vietnamese, Sudanese, and Caribbean. We were connected with our interviewees through the Worcester Advisory Food Policy Council, as well as through connections from our sponsor Liz Castro. All interviewees were able to speak English; however one interview was conducted in part in Spanish. After introductions and a discussion about the project, the interviews began with a short questionnaire (see Appendix B: Questionnaire), followed by a series of questions. Since these were semi-structured interviews participants were encouraged, through our probing, to expand on their answers

Our findings are grouped into three categories, the individual, social, and physical environments in order to explore different factors that affect food security. Individual-level factors are related to food choices and eating behaviors, including attitudes and preferences; the social environment includes interactions with family, friends, peers, and others in the community which can impact food choices through mechanisms such as role modeling and social support; the physical environment includes the multiple settings where people eat or buy food. The physical settings within the community influence what foods are available and accessible.

## INDIVIDUAL LEVEL FACTORS

### **FINDING 1: Most of the Interviewees Actively Sought to Find the Best Prices among Stores and Used Private Transportation to Obtain the Best Price**

Most of the interviewees were aware of pricing differences among stores and used private transportation to obtain the best price. Almost all of the interviewees had a car of their own. Those who did not would typically shop with a family or friend, and they would drive to the stores with the best sales. The interviewees looked at store flyers to see where the best sales were located and if it was worth the travel. The women shopped at convenient times, which was different per household. Convenient times included weekdays since weekends are often too busy, or, after work for those who are employed. The women would also shop when their spouse was home from work and could watch the kids. If they had no one to watch the kids, they would either shop during the school day,

or simply take their children with them. On average our interviewees traveled to the grocery store two or three times a month, and spent on average \$500.00.

## **FINDING 2: Use of SNAP/EBT Has Improved, However Many Families Do Not Like to Talk About its Use**

Some families were eligible for the SNAP program, which gives them assistance in buying food items like milk, eggs, bread, and other similar goods, for their family. The SNAP program distributes different amounts of government funds depending on the assessed level of need. The level of need is determined by a case-by-case basis. The interviewees like that they no longer need to use coupons at the check-out till but can use a plastic card, indistinguishable from a credit card. The women enjoyed using their SNAP benefits at the seasonal Farmer's Markets. However, the women would like to see a year-round farmers' market, or a similar option allowing them healthier options year round in place of the farmers' markets.

## **FINDING 3: Interviewees Try to Avoid Shopping at Convenience Stores Due to High Pricing**

Most interviewees will not shop at convenience stores if they can help it. They are not willing to spend more money for the sake of convenience, unless they're pressed for time. One woman stated, "If I need milk I'll stop. I would never say I shop there, only 'pick up' things. Quick." A general consensus of interviewees is that convenience stores are actually a great place to buy milk because they noted, "it is usually cheaper than the grocery stores."

## **FINDING 4: Residents Are Able to Find Ethnic Foods but Are Unwilling to Pay High Prices for Them**

Many of the interviewees could buy ethnic foods, such as platanos, rice, and beans at their local bodega, or Spanish corner store, however the price, in their view, tends to be very expensive. While they look for cultural foods everywhere they shop, they usually can only find it at high end supermarkets such as Shaw's or Big Y, or at the area's Spanish store, Compare Foods. Most of the interviewee can find Hispanic foods at Compare foods or smaller groceries, but would like to see such food sold a reasonable price at larger grocery stores. The interviewees spent time and extra

money looking for ethnic foods, allowing them to pass the culture of their food and meals within their family as much as possible. All of the interviewees knew where to go if they wanted ethnic food. No one complained that they could not buy ethnic food. However, they all would like to see it more frequently and offered at better prices.

## THE SOCIAL ENVIRONMENT

### **FINDING 5: All of the Interviewees Cook at Home Rather Than Go Out to Eat**

Every parent interviewed was very proud that they still cook at home every night, even though they would like to see more cultural foods in local stores. All of the interviewees who we talked to about this subject were women, and all would be considered to be the head of the household. Many of these women did not work, and were living on unemployment and SNAP benefits. The others who worked full time would cook dinner when they got home from work. One of the interviewees ran a daycare. She cooked for the small children every day, and made sure to bake the snacks or use fresh veggies rather than fried or processed foods. This woman was born in America. Other women who immigrated tried to visit their ethnic stores as much as possible; however simply Americanizing their meals to frozen foods or deli sandwiches was clearly easier. They would cook traditional dishes from their countries of origin from time to time. For example rice, beans and plantains for the family from the Caribbean, or for the family from Vietnam, 'Pho' a traditional Vietnamese soup. Differences in food vary greatly from the interviewees' countries of origin to here in the United States. Some of the differences include the level of freshness and aroma.

## THE PHYSICAL ENVIRONMENT

### **FINDING 7: Interviewees Do Not Enjoy, nor Go to Fast Food Restaurants**

Interviewees did not like fast food. There was only one mother who claimed she let her child eat at fast food restaurants. They stated how they did not like how they didn't have control of what was in the fast food. Another reason was that they simply couldn't afford it. The women explained how in the past, after a meal at a fast food restaurant her kids were hungry shortly after. Furthermore she felt that the poor quality of fast food was unhealthy and only provided short term hunger relief, in comparison to a home cooked meal. The women continued to explain how her

family never goes out to a sit-down restaurant unless it is a special occasion due to extremely high prices.

**FINDING 8: Public Transportation, such as Buses, is Adequate; however More Frequent Service to Supermarkets Would Make Healthy Food More Accessible**

Ease of access to grocery stores is an important factor for our interviewees. Being able to get to a store influences the choice of where to shop. In our interviews we found that residents who take public buses to the grocery stores are generally very happy with the routes available and the close proximity of bus stops to grocery stores. By contrast, the interviewees noted that taking a bus only allows for a limited amount of groceries to be bought, since one person only has two hands to carry groceries, making the number of trips to the grocery store more frequent. In winter, when public transportation is less reliable, snowstorms can change the bus routes, making it less convenient to use them to get to grocery stores. This causes people to shop at their neighboring convenience store or as some interviewees noted, to just “go without” when the bus schedules are few and far between. Another option would be the use of private taxi cabs; however this option is usually tossed aside due to the high price of taxi travel.

**FINDING 9: Very Few Interviewees Walk to the Grocery Stores**

Few interviewees walk to grocery stores due to a number of reasons. Distance to the store is an important factor. Some neighborhoods have a grocery store within a mile, but others like Plumley Village, a public housing project in Worcester, do not have a grocery store within a 1.5-mile radius. Those who do walk sometimes walk up to 20 minutes to the store, or take the bus to the nearest bus stop and walk the rest of the way. Since many of the women interviewed are single parents with young children, it is difficult for them to walk that distance to the stores and back. Some of the interviewees noted that if they wanted to walk to the grocery store on their own, finding and paying for a reliable babysitter was too expensive.

**FINDING 10: Many Interviewees Feel Safe in Their Respective Neighborhoods**

Many researchers have argued that residents’ perceptions of neighborhood safety will affect their decisions where to shop. The interviewees noted that there are not many areas where they do

not feel safe walking at night. A few women noted particular streets or storefronts where it, “Smelled like drunks, it’s close to the liquor stores where the bums hang out.” The reason for this could be due to the time spent living in the area and the social network the women have in place. The perceptions of dangerous neighborhoods seem to come from those who lived outside the neighborhoods, not from the residents who themselves live in the neighborhood.

#### **FINDING 11: Interviewees Wanted More Ethnic Grocery Stores and Cleaner Shops**

The primary concerns among those interviewed were having the opportunity to shop for larger variety of groceries, specifically ethnic food and cleaner areas to shop. When provided with the idea of how to get good food into the neighborhoods, a couple women brought up the idea of a veggie delivery truck, instead of an ice cream truck. This truck would bring healthy fruits and vegetables into the low-income neighborhoods in order to push healthy foods and make them more readily available. This paired with the healthy cooking classes provided by the Worcester Food Advisory and Active Living Policy Council would lead to a better education about healthy food and more options to eat more nutritional meals.

## 5. Recommendations

### Recommendation 1: Improving supermarket accessibility

Bus routes provided by the Worcester Regional Transit Authority do go from Great Brook Valley, Grafton Hill, and Lincoln St, and Main South to supermarkets, such as Price Rite and Price Chopper, however, the buses do not run to intercity supermarkets that are of interest to low income families, such as BJ's which is on Rte. 20 in Auburn. In addition to new stops, there is a need for more frequent bus times during the winter. Another idea would be for stores to offer return transportation for shoppers who spend over a specific amount. For example Compare Foods on Main St offers a free taxi ride for patrons who spend over \$50.

### Recommendation 2: Informing the immigrant community

The food assistance programs, such as SNAP, are well known in the Worcester area; however some immigrant and refugee families new to the area do not know all of the available options for them, such as the cooking class, or food pantries. A clearinghouse to better spread the message of the Worcester Food and Active Living Policy Council (WFALPC) would help get their work out to more of the Worcester area. As of right now, the WFALPC has a website and uses word of mouth to spread knowledge about these programs. However, flyers in English, Spanish and other languages would be helpful, especially at local Laundromats, bodegas, and grocery stores. One other recommendation would be that supermarkets in Worcester gather better information about the food preferences of the diverse communities in Worcester.

### Recommendation 3: Bringing fresh food to food insecure areas

We recommend delivering fresh fruits and vegetables to low-income areas. One idea that has already been mentioned, and should be developed is the Fruit and Veggie truck, in place of the ice cream truck. This could increase healthy options for families in low-income areas, and allow them to get to healthy foods without having to take the bus or find a way to the grocery store. Another way to do this would be to have a type of bicycle delivery program where a bicycle contains a large cargo full of fresh fruits and vegetables, similar to the veggie truck idea, and delivers the food throughout the neighborhood. This idea is much more sustainable and wouldn't cost as much money to maintain.



#### Recommendation 4: Implementing a Worcester healthy corner store initiative

When we collected HFAI and food pricing data from corner stores in Worcester, we found that they were often lacking fresh foods and healthy processed food alternatives. The Boston Public Health Commission has begun a pilot program called The Corner Store Initiative which aims at improving corner store food quality throughout the city of Boston. Participating corner stores are required to, with the assistance of The Corner Store Initiative, stock fresh produce and healthier food options as well as advertise these healthier options. Assistance from The Corner Store Initiative comes in the form of incentives and technical assistance as well as product placement and marketing assistance.

We recommend that Worcester establish a program similar to The Corner Store Initiative which aids corner stores throughout the city in stocking a wider variety of healthy food merchandise through the use of incentives, marketing and technical assistance, and product placement while holding corner store owners ultimately responsible for expanding the amount of shelf space dedicated to healthy foods.

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## Appendix A: Interview Transcriptions

### *A1: Great Brook Valley:*

On March 5<sup>th</sup> 2012, we conducted an interview with two women who live in Great Brook Valley, Worcester MA. We interviewed them in order to see their grocery shopping patterns, and in order to study their relationship with food within that area. One of the women has lived in Great Brook Valley for most of her life; the other has been living there for a year.

One popular shopping place for the residents of Great Brook Valley is the Great Brook Valley Market, commonly called Manerva's. This market has great variety. It is a good place for the simple weekly market visits, such as milk and bread. The owner of the market is well known, and will order specialty food items if is asked to do so. The two women both do their larger purchases at the Stop and Shop on Lincoln St. Both women either use the bus or other means of transportation (friend or family member) to get to the grocery store, since neither one has a car of their own. The women spend about 450-600 dollars a month on average, and both use the EBT/ SNAP program.

One of the women was very adamant about only shopping at Stop and Shop or the GBV Market. She was not concerned with clipping coupons or following the sale. This is mostly due to the fact that the bus goes to Stop and Shop directly and is fast and easy. Sometimes she will simply shop at GBV Market due to the fact it may be even quicker and the money she saves by not taking the bus is about equal to the extra spent at the market. She wasn't concerned with healthy food either. This is due to the fact that her son and herself were both naturally skinny. "I buy what taste good and is fast to make," she said. She brought up how her son always wants to 'eat on the go' and how sometimes he would skip dinner because he wanted to go out. It was much easier to get him to eat something quick like a sandwich or a hot pocket.

The other woman was the exact opposite. She was willing to follow the sales, since she did most of her grocery shopping with a family member. She clipped coupons when necessary. She runs a day care in GBV during the day so she sometimes has to buy in bulk for the larger number of children and is very concerned with the health level of the food. She likes to bake her food rather than fry it. She has tried to grow her own vegetables once in the soil in GBV but the ground is very dirty and unclean, causing a poor and uneatable quality of produce. However, she is able to enjoy fresh fruits and vegetables at the farmer's markets that are offered during the summer time.



The wintertime proves to be more difficult for getting food. Mostly because the bus schedules change to every other hour, and sometimes the routes change to the snow routes, which make them more difficult to maneuver and get where you need to go. Safety used to pose a concern for those living in the GBV area, however with a greater police presence, the area had offered itself to be one of more promise than before.

Both women have shopped at other locations before, Compare foods, Walmart etc, and however have only found not so great prices at a further distance, so they would rather just stay in the area at Stop and Shop. They have both gone into Aldi once before and neither had returned for a second visit due to the price and poor selection in their store.

### ***A2: Plumley Village:***

This interview was conducted with four women who live in the Plumley Village Complex, and one woman who worked there in Wellness center. We began with a survey that was passed out amongst the women, which talked about their shopping patterns, spending patterns, and family breakdown. A few questions were asked regarding income and such things that were on the survey for anonymity reasons; other questions were simply to get their minds flowing with ideas for the interview questions to follow. We chose to do this survey method for privacy reasons.

All of the women were the primary shoppers in their households. Many of them only had one dependent, making the average amount spent per month, anywhere from 40-200 dollars a month; seem much lower than other areas in Worcester. Some women had their own car; two took buses or walked to the stores. They were very satisfied with the bus routes, seeing that they were dropped off about 100 feet from the store. The only problem was they had to frequent the store more often since they can't carry a lot of bags at once. Women who drove their own car did not seem to have this problem.

Price Rite was a top name for all of the women for their groceries. However, once again, all the women said they would not buy their meat from there. "The prices are great at Price Rite, but I think there's something up with their meat department," one woman said. Another popular choice was Price Chopper on Highland St. However when mapping these stores distances, both fall over one mile away, making their walkability a little unrealistic.

All of the women were very against shopping at convenience stores. “Only for milk, and sometimes for emergencies,” all the women agreed. Even though there is a tiny convenience store inside of the complex, which is the only walkable market, so that is what is their only option is when it’s an emergency. Other than that, they must drive or wait for the bus to get to the supermarkets for the reasonably priced goods. The women who were able to drive would go find the sales, or even go to Sam’s club to buy in bulk if that was the cheaper option.

All of the women generally cook at home, unless it is a special occasion. They were not big fans of McDonalds or fast food restaurants. When the women were looking for cultural foods, they would head down to the Main South area to go to Compare Foods or the Vietnamese market for fish.

When asked what would they like to see changed in the Plumley area, the women all agreed that they would like to see a grocery store closer to the complex, a walkable distance. “Imagine if you had two children, and had to take the bus to the grocery store, how hard is that!” This is a very good point, since childcare can be very expensive, it may be cheaper to take your children shopping, but when you don’t have a car, you have to maneuver around Worcester the best you can. It would make life much better for the families of Plumley if there was a grocery store available.

### ***A3: Main South:***

When the women first walked into the room, we introduced ourselves and asked where everyone’s country of origin was. The four women represented four different countries; Sudan, Vietnam, the Caribbean and Puerto Rico. We began with a survey that was passed out amongst the women, which talked about their shopping patterns, spending patterns, and family breakdown. A few questions were asked regarding income and such things that were on the survey for anonymity reasons; other questions were simply to get their minds flowing with ideas for the interview questions to follow. We chose to do this survey method for privacy reasons.

They all showed to be the primary grocery shopper in their households. On average they said to shop once a week, spending between 100-200 dollars per trip. When it came to the question of whether or not they brought children or spouses with them varied. None of the women brought spouses with them while shopping; however two of the four were single moms. I wish I had prodded more about the reasons why the women did or did not bring the children.

We opened the interview with talking about convenience stores, and if the women bought their groceries there. They all felt very strongly about not purchasing their groceries at a convenience store, except milk, which has shown to be cheaper and name brand at the convenience stores, rather than Price Rite and Stop and Shop which sold the generic brands for cheap. I agreed with this. It is a common observation that prices in convenience stores are higher, and the reason is in the name, you are paying for convenience.

The women's top store choices were all very similar. Price Rite, Price Chopper and Stop and Shop were three of the most popular choices. Two women agreed on Compare foods, while at least one large chain appeared on every woman's list; Wal-Mart, Target, Sam's club. When we talked about why they chose these stores, there were a variety of different reasons they shopped there.

The main and most important reason was quality. Price was of course a close second, but all of the women agreed that groceries were not worth any money if the product was not good. This was especially relevant when it came to the topic of Price Rite. It is known as one of the cheapest grocery stores in the Worcester Area, however with this cheapness it is also noticed that you sacrifice freshness. The women were unanimous with the statement that they would not buy their meat or seafood there, only vegetables and non-perishables. This also coincided with the cleanliness of the store. Price Rite was spoken of as dirty and not well maintained. They were very specific about the meat section at Price Rite, which it is not fresh and has a certain bad odor that is synonymous with poor refrigeration and non-fresh meat. Another store that was brought up in this category of dirty and unkempt is Compare foods. It also is a holder of cheap prices and ethnic foods. The woman also felt badly about Santiago's market. Also, one woman claimed to see a rat and droppings in the store. One of the worst descriptions was for Pennywise markets; they illustrated it as "uncomfortable while shopping there due to the smell of alcohol seeping off all of the bums."

The women chose the 'buy in bulk' stores for large events. For example, they would shop there if they needed to buy a large quantity of items for holidays, or large quantities of non-perishables. However, the women thought it was impracticable to shop in bulk, due to high waste. They would never buy their vegetables or fruits from these brand of stores, simply because there is no way they could make it last without having to throw away half of it. Even items you can freeze can eventually go bad and get freezer burn.

The Compare Food Store, and Macon Market were shown to sell more ethnic types of food. Patel Brothers in Westborough was also a good place named for good ethnic food. The women all generally disliked Shaw's due to their high priced shelves, however they were attracted to the "Around the World" aisles, which followed suit in expense, but they have items that they cannot find elsewhere.

When we stayed on the topic of Shaw's, it was said that they used to be one of the cheapest stores around, however in recent years they have become more and more overpriced. The "sales at Shaw's aren't even sales", one woman said in reference to the fact that other stores carry items cheaper than what Shaw's offers at a 'sale' price. At times they do have to succumb to the high prices supermarkets charge for the ethnic foods that they want, but other than that they would not even consider Shaw's as a shopping option.

All of the woman besides one had a vehicle to use for grocery shopping. They said that if the grocery store is local that it is a nice addition, but they tend to follow the sales wherever they may be. Even the woman who took the bus to certain stores said she would rather travel farther for the sales, because the money she spends on the taxi home is not too bad in comparison to the money she saves by shopping where the sales are. She also mentioned how the Compare Foods store used to, and may still; offer a free taxi ride home when you spend 50 dollars or more on the groceries.

The question of the differences between the food here and the food in their home country was answered unanimously. Back in their countries, the food is fresh. It is not picked while unripe and sent around the world with preservatives and chemicals before you buy it like in America. They described the bananas as big and full of flavor, and their mangoes tasted blew the mangoes here out of the water. One woman asked, "How come at home when I cut an apple or fruit, you can smell it everywhere! But here, you smell nothing." The answer is between the nutrient deprived soil, unripe picking, and chemicals that cause the problems with the fruit.

We asked the women what they thought needed to be changed; the first answer was to make the bus routes close to the grocery stores. One woman who takes the bus has to take the bus to the closet stop, then walk 1/2 a mile, then call a cab home. Another suggestion was to have the farmer's market in Crystal Park, instead of the YMCA's parking lot. They think it's a much better place; more relaxing and clean to sell fruits, also easier to bring children to in the park. One last idea which was great was a "Vegetable truck", similar to what we know as an ice cream truck!

## Appendix B: Interview Survey

Interviewee Name:\_\_\_\_\_

Date:\_\_\_\_\_

Interviewer Name:\_\_\_\_\_

Method of Contact:\_\_\_\_\_

### **Questions:**

#### **1) Introduction Questions**

- What do you think about the quality of food that is available in corner stores, convenience stores, and supermarkets?
- Are there foods that you would like to buy which are not available in any store?
- Who does the shopping in your household?

#### **2) What are Worcester resident's food shopping patterns?**

- Where do you do your grocery shopping and why?
- How many times a month do you grocery shop?
- How much on average a month do you spend on groceries?
- Do you make use of the EBT Card or WIC programs?

#### **3) What are the transportation trends amongst Worcester residents?**

- How do you get to your food source of choice?
- Do you feel safe walking through your neighborhood?

#### **4) Do Worcester residents have the food available that they want?**

- How many times a week do you cook dinner at home?
- How is the food different here than your country of origin?
- How are eating patterns different?

#### **5) How do Worcester residents perceive their local food system?**

- As of now, what do you think the main 'food issues' are in your community?
- What would you change about the stores you shop in?
- What do you think of the kinds of foods that are available, what would you like to see added to the shelves?

Nombre de Entrevistado:\_\_\_\_\_

Fecha:\_\_\_\_\_

Nombre de Entrevistador:\_\_\_\_\_

Método de Contacto:\_\_\_\_\_

**Preguntas:**

**1) Preguntas de Introducción**

- ¿Qué piensa usted acerca de la calidad de los alimentos que está disponible en tiendas de abarrotes, tiendas de conveniencia y supermercados?
- ¿Hay alimentos que desea comprar, que no están disponibles en cualquier tienda?
- ¿Quién hace las compras en su hogar?

**2) ¿Cuáles son los patrones de residente de Worcester compra de alimentos?**

- ¿De dónde hacer sus compras de comestibles y por qué?
- ¿Cuántas veces al mes en el que se tienda de comestibles?
- ¿Cuánto en promedio al mes se gasta en alimentos?
- ¿Hace uso de la tarjeta de EBT o los programas de WIC?

**3) ¿Cuáles son las tendencias del transporte entre los residentes de Worcester?**

- ¿Cómo llegar a su fuente de alimento de elección?
- ¿Se siente seguro caminando por el vecindario?

**4) Los residentes de Worcester tiene la disponibilidad de alimentos que ellos quieren?**

- ¿Cuántas veces a la semana a cocinar la cena en casa?
- ¿Cómo es la comida diferente aquí, entonces, su país de origen?
- ¿Cómo son los patrones de alimentación diferente?

**5) ¿Cómo perciben los residentes de Worcester su sistema local de alimentos?**

- A partir de ahora, ¿qué crees que los principales "problemas alimentarios" están en su comunidad?
- ¿Qué cambiarías de las tiendas a comprar en el?
- ¿Qué piensa usted de los tipos de alimentos que están disponibles, ¿qué le gustaría ver añadido a las estanterías?

## Appendix C: How to transfer Excel data (Lat, Long) to ArcGIS 10

- 1) File – Add Data – Add X-Y Data
- 2) Browse for your Excel Data file
  - a) X-Field = Longitude
  - b) Y-Field = Latitude
- 3) Coordinate System of Input Coordinate's:
  - a) \*In your Excel your coordinate points must be in Decimal Degree's
  - b) Click Edit -- Clear the current coordinate system
  - c) Click Select – Click Geographic Coordinate Systems – Click World –Select WGS 1984.prj
  - d) Click Ok at bottom
- 4) Click Ok at the bottom of original window and your data will appear on your map

## Appendix D: Create Shapefile from Data you just imported

1. Left-Click under the Table of Contents of the data you just imported.
2. Go to Data – Export Data
  - i) Make sure it says-
    - (1) Export: All Features
  - ii) Use the same coordinate system as:
  - iii) This layer's source data
3. Save this file to your choosing
4. Click Ok and the data you imported will become a shapefile on your map
5. You can then delete the data you imported before under the Table of Contents



## Appendix E: Additional Maps

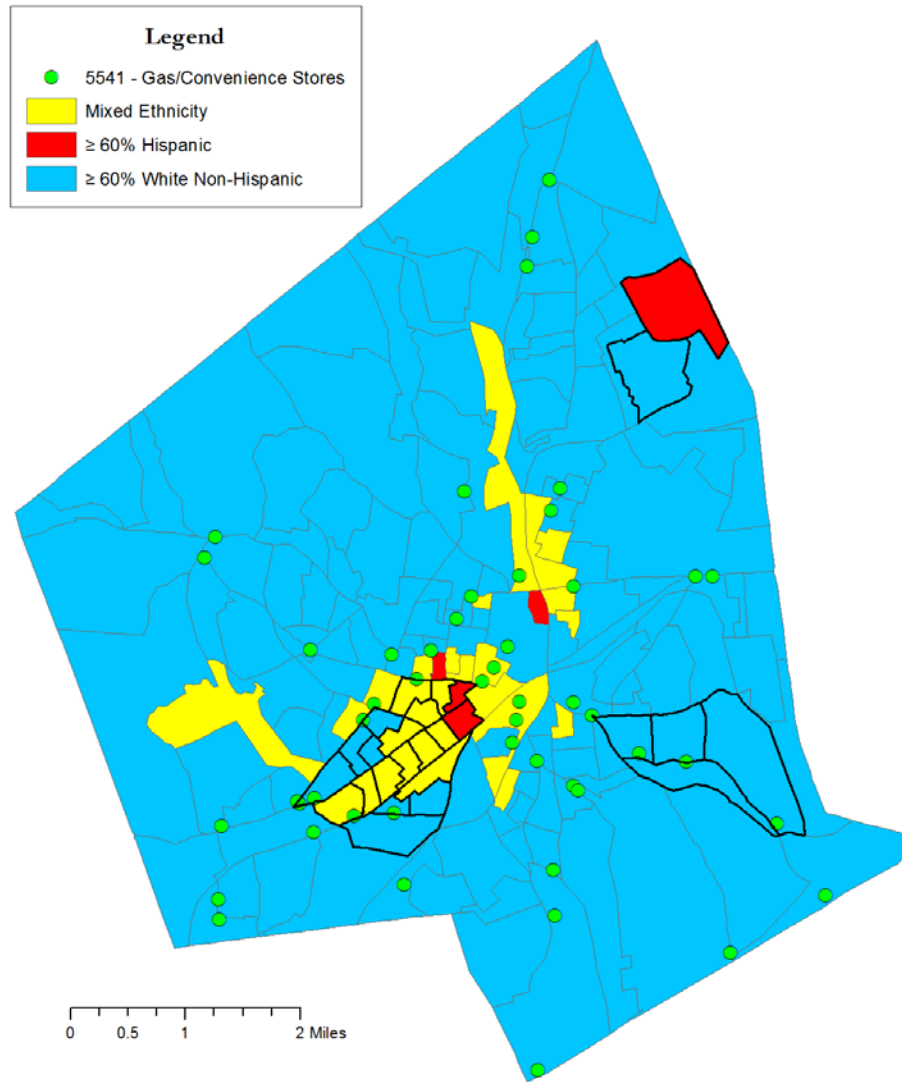


Figure 10: Block Group Ethnic Composition and Gas/Convenience Store Locations

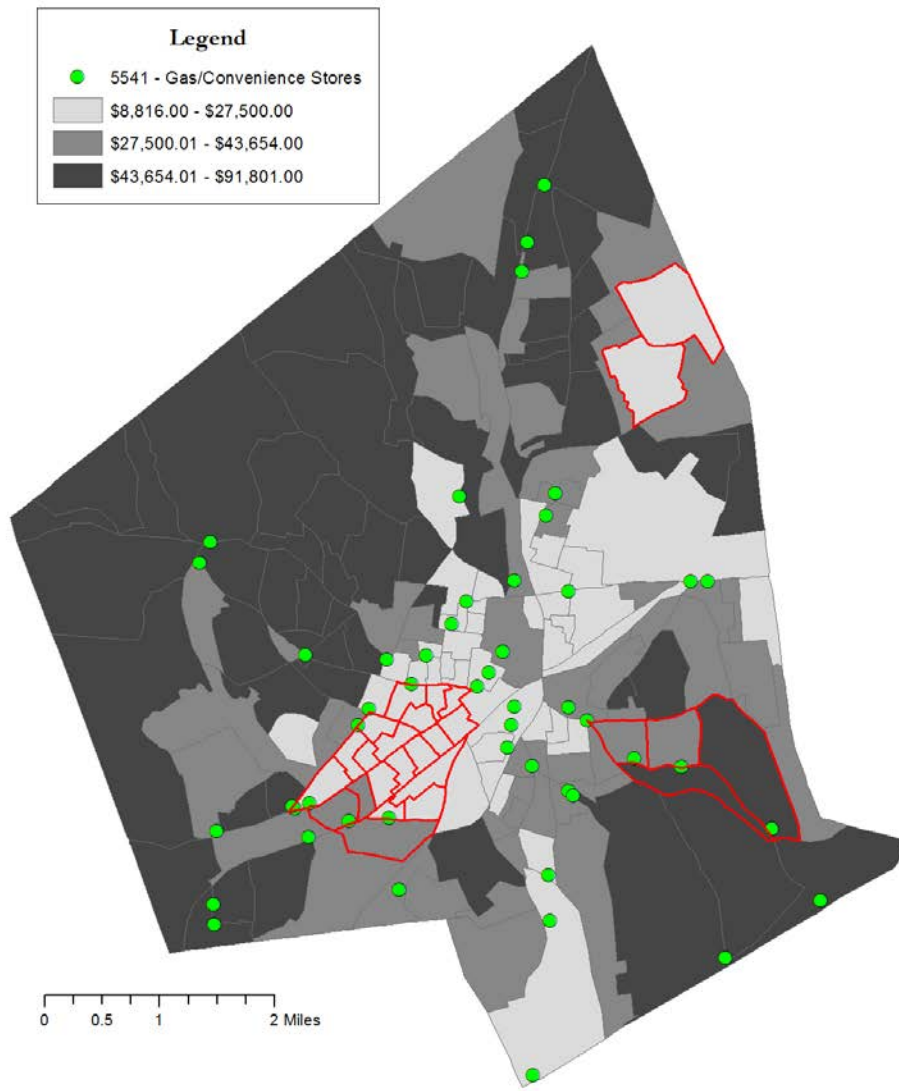


Figure 11: Block Group Median Household Income and Gas/Convenience Store Locations

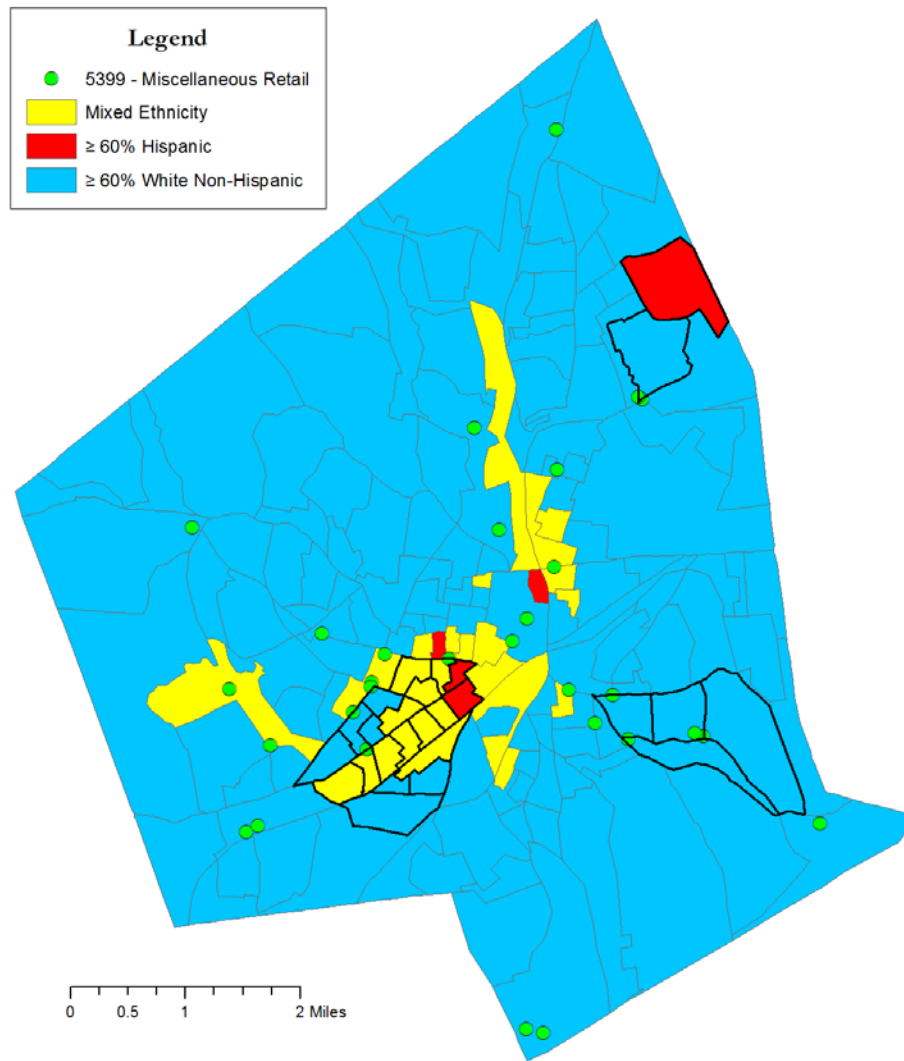
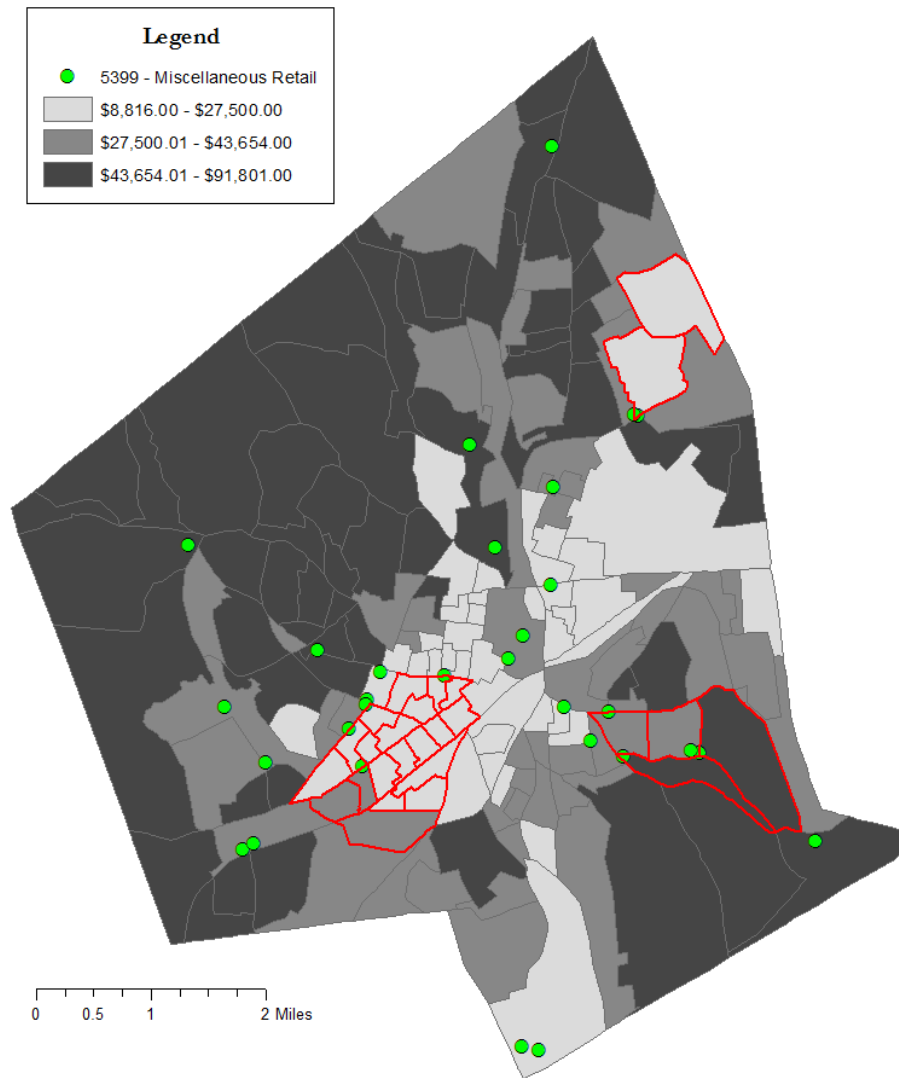


Figure 12: Block Group Ethnic Composition and Miscellaneous Retail Locations



**Figure 13: Block Group Median Household Income and Miscellaneous Retail Locations**

## Appendix F: Pricing Data Collection Form

Source Name: \_\_\_\_\_

Source Type: \_\_\_\_\_

Source Address: \_\_\_\_\_

Surveyor: \_\_\_\_\_

### **Meats:**

90% Lean Ground Beef      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Chicken Breast      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

### **Grains:**

Wheat Bread      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per loaf) \_\_\_\_\_

White Rice      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Dry Pasta      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Dry Cereal      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

### **Vegetables/Starches:**

Corn      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Potatoes      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Broccoli      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Carrots      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

### **Fruits:**

Apples      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Bananas      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Oranges      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Grapes      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

### **Dairy:**

Eggs      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per dozen) \_\_\_\_\_

Skim Milk      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per gallon) \_\_\_\_\_

American Cheese      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

Yogurt      Available: Yes \_\_\_\_\_ No \_\_\_\_\_      Price(per lb) \_\_\_\_\_

## Appendix G: Culturally Adapted HFAI

While the HFAI fulfilled its purpose, several aspects of it could be addressed to provide better results. One short coming of the HFAI was the lack of cultures it represented. Worcester being a diverse city has large African, Hispanic and Asian populations, which were under represented with this method. The HFAI's other flaw was the point distribution, which needed more scientific justification and more numerical weight.

On the next page is an example of a new culturally adapted HFAI. The points are now assigned proportionally to the respective food's percentage of daily consumption. Therefore grains, being largest portion of the USDA's food plate, have the highest numerical weight. The new HFAI also attempts to address the cultural flaw of the previous HFAI by trying to represent Asian cultural foods. The next step would be to add sections to represent the other various cultures in Worcester such as African and Hispanic however, more research would need to be done to fully understand the difference between cultural food and healthy cultural food.

Food Group	Healthy Score	Availability Score
<u>Dairy:</u>  A) Milk B) Cheese C) Yogurt	A) Skim/Soy/ 1% =2 pts Each B) Organic/Low Fat=1pt C) Organic Brand=2pts	A) >50% =1pt, >75%= 3pts B) >2 Brands=1pt C) >2 Brands=1pt
<u>Fresh Fruits:</u>  A) All Fruits	A) Seasonal or Organic Fruit =3pts B) Cultural Fruits=3pts	A) >20 types=1pts, >40types=3pts, B) >5 types=2pts, >10 types= 4pts
<u>Fresh Vegetables:</u>  A) All Vegetables	A) Seasonal/Organic Vegetables=2pts B) Cultural Vegetables=2pts	A) >20 types=1pts, >40types=3pts, B) >5 types=2pts, >10 types= 4pts
<u>Meats:</u>  A) Chicken B) Ground Beef C) Turkey D) Fish	A) Skinless Breast =2pts B) 93% Lean Beef=3pts C) Fresh Turkey=3pts D) Fresh Fish=3pts	A) >30%=2pts, >40% =4pts B) >30%=2pts, >40% =4pts C) >3 types=2pts, >6 types= 4pts D) >3 types=2pts, >6 types= 4pts
<u>Grains:</u>  A) Bread B) Pasta C) Cereal	A) Whole Grain Bread=4pts B) Whole Grain Pasta=4pts C) Brown Rice=4pts D) Whole Grain Cereal=4pts	A) >3 Brands=5pts B) >3Brands=5pts C) >3Brands=5pts D) >3 Brands=5pts
<u>Asian Cultural Foods:</u>  A) Rice B) Sea Food C) Soy	A) White Rice= 3pts B) Calamari/Shrimp/Fresh Fish=2pts C) Soy Beans/Tofu=3pts	A) >3 Brands=3pts B) Recently Prepared=3pts C) >3 Brands=3pts
<u>Source Name:</u>  Type:  Overall Score:	Healthy Score: MAX(64pts)	Availability Score: MAX(77pts)